RECORD OF DECISION

for the

WESTERN GROUNDWATER OPERABLE UNIT OU-3

AEROJET SACRAMENTO SITE,
RANCHO CORDOVA, CALIFORNIA

U.S. Environmental Protection Agency
Region 9
San Francisco, California

July 20, 2001

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PART 1: THE DECLARATION

1.1 Site Name and Location - Aerojet-General Corporation, Sacramento County California Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Identification Number CAD980358832.

1.2 Statement of Basis and Purpose

1.2.1 This decision document presents the United States Environmental Protection Agency's (USEPA's) Selected Remedy for the Western Groundwater Operable Unit at the Aerojet-General Corporation (Aerojet) site in Sacramento County, California, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the USEPA's Administrative Record file.

1.2.2 The State of California concurs with the Selected Remedy.

1.3 Assessment of Site - The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment; and pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

1.4 Description of Selected Remedy

1.4.1 This remedial action for Western Groundwater Operable Unit (OU-3), addresses contaminated groundwater by containing and remediating the contaminated groundwater on the western side of the Aerojet Superfund Site with a groundwater Pump and Treat System (P&T) to mitigate the loss of additional drinking water supplies in a populated area.

1.4.2 The site is being divided into operable units (OUs) because of the overall size of the remediation effort and to expedite the remediation. Due to the impact of contaminated groundwater on public drinking water supplies, the site cleanup strategy is to give priority to containing and remediating the contaminated groundwater extending from the Aerojet Site, followed by remediation of on-property contaminated soil and groundwater. The containment and remediation of contaminated groundwater surrounding the Aerojet Site is being divided into two OUs, the first of which is the Western Groundwater OU to stop the loss of drinking water supplies in the most populated areas. The remaining contaminated groundwater near the boundary of the Aerojet Site will be addressed in the Perimeter Groundwater OU with a ROD anticipated in 2004. The scope of the on-property soil and groundwater remediation effort is still being determined but it is anticipated that the size of

the effort will require at least four OUs.

1.4.3 There are no known source areas or Non-Aqueous Phase Liquids (NAPLs) in OU-3 and as a result principal threat waste was not considered for OU-3.

1.4.4 The OU-3 remedy includes the following actions:

1.4.4.1 Contain contaminated groundwater off-property within OU-3 with P&T in all contaminated layers of the aquifer to prevent further contamination of the aquifer;

1.4.4.2 Contain the contaminated groundwater on-property which is feeding the off-property groundwater contamination at the Aerojet's property boundary through P&T in all contaminated layers of the aquifer;

1.4.4.3 Restore all layers of the aquifer between the on- and off-property extraction systems to their beneficial use as a drinking water aquifer;

1.4.4.4 Treat extracted groundwater using biological treatment for Perchlorate, ultraviolet oxidation for N-Nitrosodimethylamine, and air stripping for residual Volatile Organic Compounds (VOCs);

1.4.4.5 The Treated groundwater shall be discharged directly to the drinking water system or discharged to surface water. Any discharge to a drinking water system shall comply with Federal Drinking water standards as well as California Department of Health Services, Division of Drinking Water and Environmental Management requirements.

1.4.4.6 Water replacement contingency planning and implementation shall provide for the following:

- Develop, implement and augment as required a short-term water replacement contingency plan to replace on a temporary basis private and public drinking water and irrigation well water supplies lost to Aerojet contamination within OU-3;

- Develop and implement a long-term water replacement contingency plan for timely permanent replacement of existing private and public drinking water and irrigation well water supplies lost to Aerojet contamination within OU-3;

1.4.4.7 Monitor groundwater at drinking water wells, irrigation wells, up-gradient sentinel wells, to verify and evaluate plume control, and effectiveness of the remedy;

1.4.4.8 Create a groundwater management zone within OU-3 to maintain water levels and to prevent adverse impact on the remedy;

1.4.4.9 Implement Institutional Controls (ICs) with this remedy including Sacramento County review of new well drilling permits; prohibitions on access to groundwater and environmental restrictions on the land overlaying the contaminated groundwater; and notification to drinking water suppliers if treated discharge to a drinking water supply exceeds Californica Department of Health Services drinking water action levels.

1.4.4.10 Provide an evaluation of *in-situ* bioremediation as a possible revised groundwater remedy to augment P&T to allow USEPA to assess if *in-situ* bioremediation can economically and effectively reduce the time for remedy completion. Such a remedy revision would be accomplished by an Explanation of Significant Differences

1.5 Statutory Determinations

1.5.1 The Selected Remedy attains the mandates of CERCLA Section 121 and to the extent practicable, the NCP. Specifically, the remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions to the maximum extent possible.

1.5.2 This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

1.5.3 Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining within OU-3 above levels that allow for unlimited use and unrestricted exposure, but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review will be conducted within five years of completion of the physical construction of the OU-3 remedy to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD Data Certification Checklist - The following information is included in the Decision Summary Section of this ROD (Additional information can be found in the Administrative Record file for this site):

1.6.1 Chemicals of Concern (COC) and their respective health-based concentrations - Page 21;

1.6.2 Baseline risk represented by the COC - Page 20;

1.6.3 Cleanup levels established for the COC and the basis for these levels - Page 59;

1.6.4 How source materials constituting principal threats are addressed - Page 48;

1.6.5 Current and reasonable anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD - Page 19;

1.6.6 Potential groundwater use that will be available at the site as a result of the Selected Remedy - Page 38;

1.6.7 Estimated capital, operation and maintenance (O&M), and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected - Page 47; and

1.6.8 Key factors that led to selecting the remedy - Page 49.

1.7 Authorizing Signature

_____ _____

Date

Keith Takata
Director, Superfund Division

PART 2 THE DECISION SUMMARY

2.1 Site Name, Location, and Description:

2.1.1 Aerojet-General Corporation, Rancho Cordova, California (Approximately 15 miles east of Sacramento, CA See Figure 2-1). It is bounded on the west by the unincorporated city of Rancho Cordova and on the east by the city of Folsom.

2.1.2 The CERCLIS Identification Number is CAD980358832.

2.1.3 The lead agency is the USEPA.

2.1.4 The expected source of cleanup monies is enforcement settlement with the Potentially Responsible Party (PRP).

2.1.5 The major sources of the groundwater contamination are from Aerojet's facilities up-gradient of OU-3. There are some small Volatile Organic Chemicals (VOCs) sources off-property which are and will be remediated by separate State actions.

2.1.6 OU-3 is approximately 14 square miles in area and includes a small portion of both the Aerojet industrial facility and the adjacent Inactive Rancho Cordova Test Site (IRCTS) as well as approximately 10 square miles of commercial and residential developed areas in the unincorporated community of Rancho Cordova (see Figure 2-2). OU-3 is not known to include soil or vadose zone source sites or NAPL. OU-3 is just north of the closed United States Air Force Mather Field, a Federal National Priority List (NPL) site.

2.2 Site History and Enforcement Activities:

2.2.1 Aerojet is a wholly owned subsidiary of GenCorp. Aerojet has operated the Superfund Site since 1953, prior to the Resource Conservation and Recovery Act (RCRA) of 1980. Operations included manufacturing liquid and solid propellants for rocket engines for military and commercial applications and formulating a number of chemicals, including rocket propellant agents, agricultural pesticides, pharmaceuticals, and other industrial chemicals. The Cordova Chemical Company operated chemical manufacturing facilities on the Aerojet complex from 1974 to 1979. Some wastes were disposed of on-property in surface impoundments, landfills, deep injection wells, leachate fields, and open burn areas. In 1979, volatile organic chemicals (VOCs) were found in private wells off-property. The most prevalent contaminants in groundwater are Trichloroethene (TCE), Perchlorate, and N-Nitrosodimethelamine (NDMA). In 1997, the practical quantitation limit (PQL) for perchlorate was improved from 400 parts per billion (ppb) to four ppb, the health-based concentration associated with standard exposure assumptions made using the low end of the provisional reference dose (RfD) range of 0.0001 mg/kg-day. The NDMA PQL has also been improved from 150 ppb to 5 parts per trillion (ppt) which

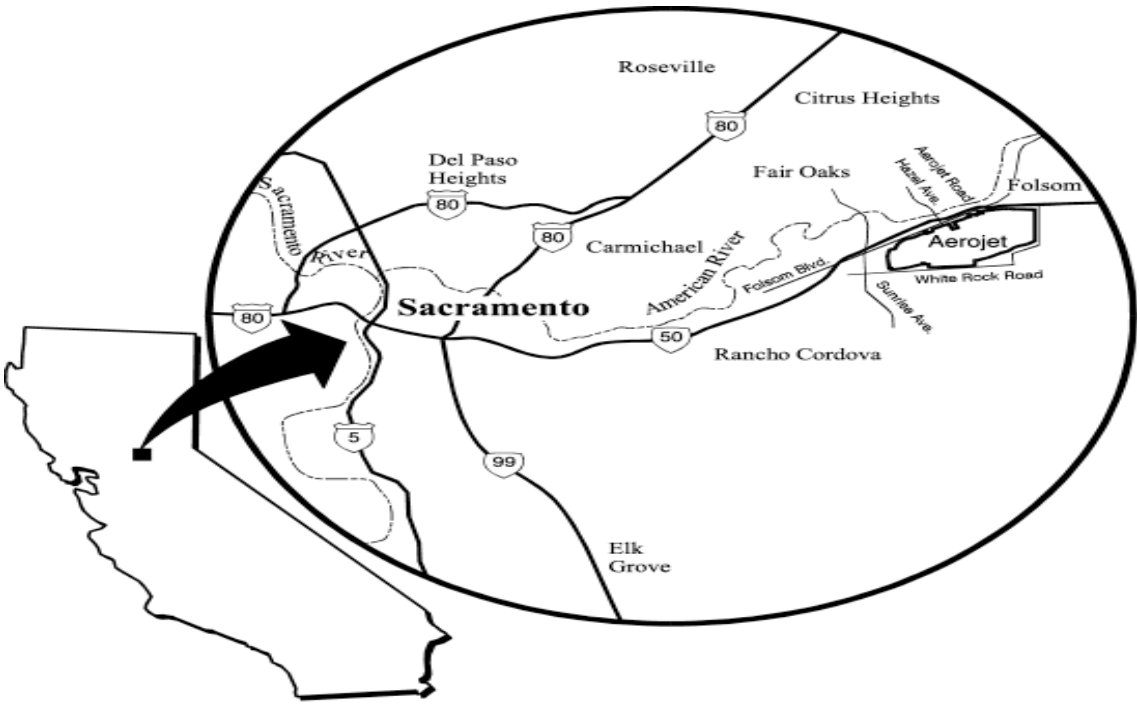
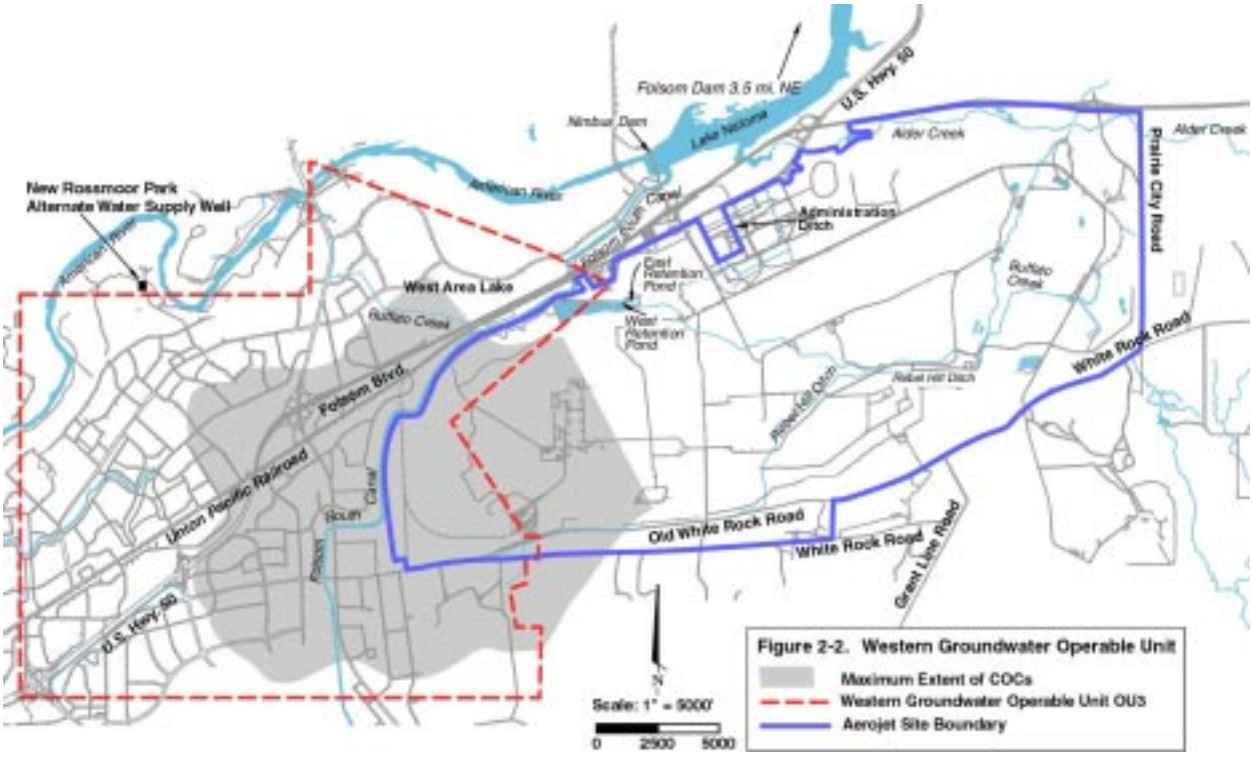


Figure 2-1. Aerojet Superfund Site Map



is still above the Preliminary Remediation Goal (PRG) of 1.3 ppt. As a result of these improved detection methods it has been determined that perchlorate and NDMA contamination of groundwater off-property is extensive. Public drinking water wells on the west side of Aerojet have been removed from service and additional wells are threatened due to groundwater contamination.

2.2.2 The Aerojet Site was placed on the NPL August 8, 1983. Portions of the IRCTS are considered part of the NPL where hazardous substances originally on the Aerojet facility migrated to or otherwise came to be located on the IRCTS. On their own initiative, Aerojet installed, between 1983 and 1987, five groundwater extraction and treatment (GET) facilities as a perimeter barrier system, primarily to prevent further off-property movement of VOC contaminants. These systems have not been fully effective. Existing GETs E and F (which will become part of OU-3) were initially designed only to treat for VOCs resulting in perchlorate and NDMA reinjection into the aquifer. On June 23, 1989, a Partial Consent Decree (PCD) was entered with the United States Eastern District Court of California. The PCD obligates Aerojet to complete a Remedial Investigation/Feasibility Study (RI/FS) for the 8,500 acre main facility, 3,820 acre IRCTS area, and three other smaller parcels (Areas 39, 40 and 41) near the main Aerojet facility, where open burning was conducted. The parties to the PCD are Aerojet General Corporation, the Department of Toxic Substances Control (DTSC), the Regional Water Quality Control Board (RWQCB) and the USEPA. The operation, maintenance and effectiveness evaluation of GETs A, B, D, E, and F were incorporated in the PCD. The PCD was modified in July 29, 1998 to add the contaminant perchlorate and to reduce the NDMA discharge limit. In December 1998 Aerojet installed, a first of its kind biological treatment system for perchlorate at GET F, which achieved full scale operation in December 1999. This treatment system treats perchlorate to less than 4 ppb, the current PQL. In July 1999, GETs E and F were combined to provide for treatment of perchlorate at GET E extraction wells and to add ultraviolet oxidation (UV/OX) treatment capability to destroy NDMA to 2 ppt.

2.2.3 At the IRCTS property, in 1995 DTSC issued an order to Aerojet requiring soil and groundwater cleanup. In 1997 the RWQCB issued order 97-093 to Aerojet and McDonnell-Douglas Corporation, requiring groundwater control and remediation of perchlorate. To address contamination on the north of Aerojet, in 1996 the RWQCB issued order 96-230 for groundwater control and remediation of groundwater contamination not remediated by GET D. In 2000, the RWQCB issued order 500-718 for containment and control of perchlorate at GET D. In addition, in 1996, the RWQCB issued order 96-259 for abatement and remediation of perchlorate off Aerojet's property.

2.2.4 The USEPA and State are negotiating with Aerojet to modify the 1989 PCD to expedite the cleanup by dividing the site into OUs, beginning with OU-3, instead of waiting to complete a single site-wide RI/FS before starting remediation. Completion of the RI/FS for OU-3 has proceeded ahead of the PCD modification.

2.2.5 American States Water Co. has filed a lawsuit in State court against DTSC and the RWQCB and a separate lawsuit against Aerojet for the reinjection of perchlorate at GETs E and F. Three toxic tort suits are also pending against Aerojet related to it's Sacramento site.

2.3 Community Participation: The RI/FS Report and Proposed Plan for OU-3 for the Aerojet Superfund Site in Sacramento, CA, were made available to the public in November 2000. These documents can be found in the Administrative Record file of the information repositories maintained at the USEPA Region 9 Record Center at 95 Hawthorne St. in San Francisco and at the California State University Sacramento Library. The notice of availability of the RI/FS, proposed plan, date and location for the first public meeting and public comment period (December 1, 2000 through January 30, 2000) were published November 30 in the Sacramento Bee and Grapevine Independent new papers. The first public meeting was held December 7, 2000 during which time a second public meeting was requested to insure all comments could be included. The Second public meeting was held January 17, 2001. Transcripts of both public meetings are part of the administrative file at the repositories and USEPA's response to comments received at the two public meetings and written comments are part of this ROD's Responsiveness Summary. An overview of the proposed plan was presented by USEPA at both public meetings and questions were taken by a panel comprised of USEPA, DTSC, RWQCB and, at the second meeting, California Department of Health Services (CADHS). A separate community meeting (not on the proposed plan for this remedy) was held March 22, 2001 which resulted in the forming of a Community Advisory Group (CAG).

2.4 Scope and Role of the Operable Unit or Response Action:

2.4.1 Aerojet is a large site with groundwater contamination that has migrated off the Aerojet property. The USEPA and the State have been negotiating with Aerojet to organize the site into OUs through a modification to the PCD. The USEPA anticipates the OU remedial actions will be implemented by Aerojet.

2.4.1.1 Operable Unit 1: Is reserved for the sitewide ROD upon completion of all the OUs. Until the PCD is modified, OU-1 is the vehicle for all RI/FS for the site.

2.4.1.2 Operable Unit 2: Was initiated in 1995 pursuant to a Unilateral Administrative Order (UAO) for control of off-property VOC groundwater contaminated on the north side of the Aerojet Site. OU-2 is also referred to as the American River OU. The UAO was withdrawn and work for this part of the site was accomplished under RWQCB Order 96-230. In July 1998 the American River GET became operational as an interim groundwater action to contain VOCs not captured on the north side of the Aerojet Site by the existing GET D. It is anticipated that OU-2 will be merged into OU-5 in the future.

2.4.1.3 Operable Unit 3**: <u>Western Groundwater Operable Unit (OU-3) is the action covered by this ROD.</u>** The purpose of OU-3 is to contain and remediate groundwater

contamination on the western side of the Aerojet Site. Nine water supply wells have been lost to groundwater contamination and it is projected that an estimated 13 additional public water supply wells could be lost over the next 25 years. Ingestion of groundwater extracted from the aquifer poses a current and potential risk to human health which is outside the USEPA's acceptable risk range.

2.4.1.4 Operable Unit 4: OU-4 will be for remediation of soil and groundwater in Area 41 caused by Aerojet's burning of industrial wastes on 500 acres of property they leased from others. Area 41 has VOC and perchlorate contamination in groundwater; and metals and perchlorate contamination in soil.

2.4.1.5 Operable Unit 5: Perimeter Groundwater OU (OU-5) will contain and remediate groundwater around the remaining three sides of Aerojet (north, east and south) not covered by OU-3. OU-5 will include Aerojet's GETs A, B, D, the American River GET and groundwater for Areas 39 and 40. Interim RWQCB orders 96-230, 96-259, and 500-718 will be incorporated in OU-5.

2.4.1.6 Operable Units 6-9: OUs 6-9 are anticipated to remediate soil and groundwater contamination on-property. As part of the pending PCD RI/FS modification for OUs, Aerojet will assess the number of OUs and priority for remediating the over 300 source sites contained in the four hydrologic groundwater zones on-property. Dense non-aqueous phase liquids (DNAPL) are known to exist in the areas to be covered by these OUs.

2.5 Site Characteristics:

2.5.1 *Conceptual Site Model*: The Conceptual Site Model (CSM) for the risk assessment and response action was based on 1) contact with contaminated groundwater in the future through use of private or domestic water supply wells and 2) calculating hypothetical risks assuming present residential exposure to water purveyor supply wells. Residential exposure through water from drinking water wells would include ingestion, inhalation and dermal contact. The health-based concentration used in the risk assessment are those that represent the current state of the plumes as well as maximum detected concentrations over the past 2 years of sampling. The major sources of the groundwater contamination are from Aerojet's facilities up-gradient of OU-3 which will be addressed in future OUs. The Aerojet groundwater contamination is deep underground at least 60 ft at the eastern end of OU-3 and slopes downward to the west. The groundwater does not seep up to the surface or impact the nearby American River. As a result, there are no known receptors for an ecological assessment. Drinking water wells are monitored and removed from service once contaminated based on California Department of Health Service regulations. Water on-property is supplied from an up-gradient off-property supply that is not contaminated.

2.5.2 *Overview of Site*:

2.5.2.1 Size: OU-3 is approximate 14 square miles in size and characterized by a relatively flat topographic surface that slopes gently downward 140 ft. to the west. The depth to shallow groundwater varies from 40 to 60 ft. in the east to 100 ft. below ground surface in the west. The depth to groundwater in the deepest layer of concern, Layer E, varies from 350 to 400 ft.

2.5.2.2 Geographical and Topographical Information: The American River meanders in a generally southwesterly direction through the northwest part of OU-3. The Folsom South Canal originates at the southwest end of Lake Natoma which is created by Nimbus Dam, is located one-quarter to one-half mile north of the Aerojet property boundary. In general, the canal parallels the Aerojet boundary. This concrete-lined canal was intended to provide water for a nuclear power plant that is currently being decommissioned as well as various municipal and agricultural water users. Other surface water features include the Administration Ditch, Buffalo Creek and the West Area Lake (see Figure 2-2). Storm water runoff from the northern and northeastern part of Aerojet (beyond the OU-3 boundaries) flows through the Administration Ditch or Buffalo Creek into West Area Lake, which is located in the northeastern corner of OU-3. Water from West Area Lake is discharged to Buffalo Creek and ultimately to the American River under a National Pollution Discharge Elimination System (NPDES) permit.

The Rebel Hill Ditch traverses the Aerojet Site from northeast to southwest and was constructed to provide water for gold dredging activities. Treated groundwater from GET-B, located east of OU-3, is discharged to the Rebel Hill Ditch, where it infiltrates into the ground along the southern boundary of the Aerojet Site (see Figure 2-2). There are also a number of lakes, ponds, vernal pools and wetlands located throughout the Aerojet Site that generally contain water only during the rainy season.

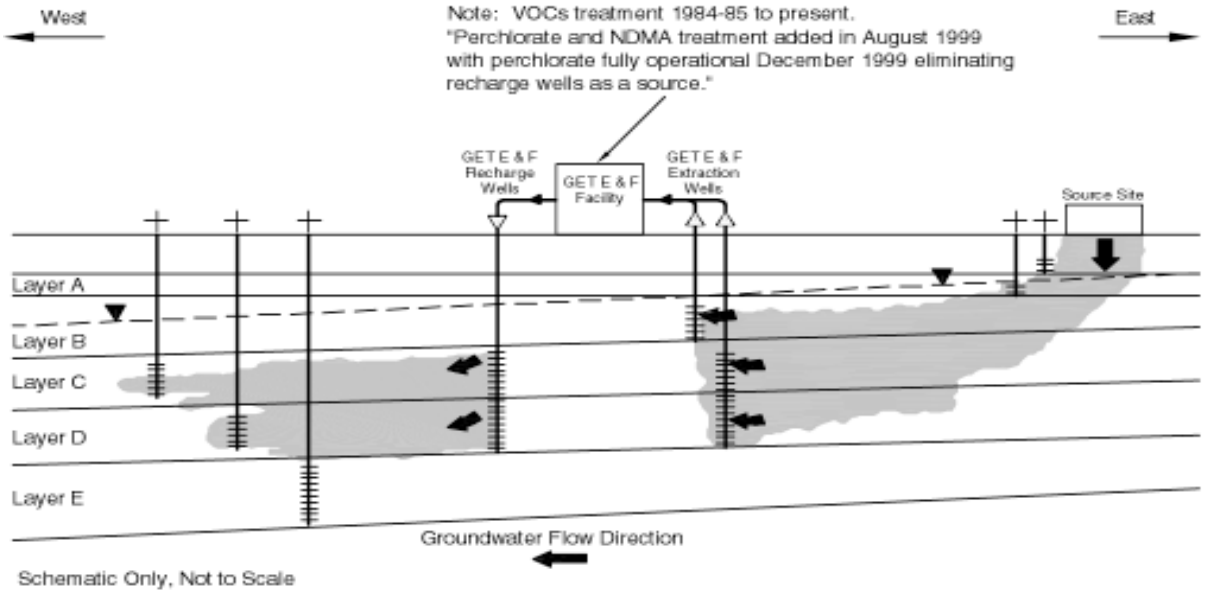
2.5.3 *Surface and Subsurface Features*: The eastern part of OU-3 contains structures built as part of the GETs E and F groundwater extraction and treatment facilities and a few other structures associated with Aerojet operations. Most of OU-3 is located in Rancho Cordova and has been fully developed with residences, commercial buildings and light industry. The area was part of the 1800's gold rush. However, there are no known areas of archaeological or historical features.

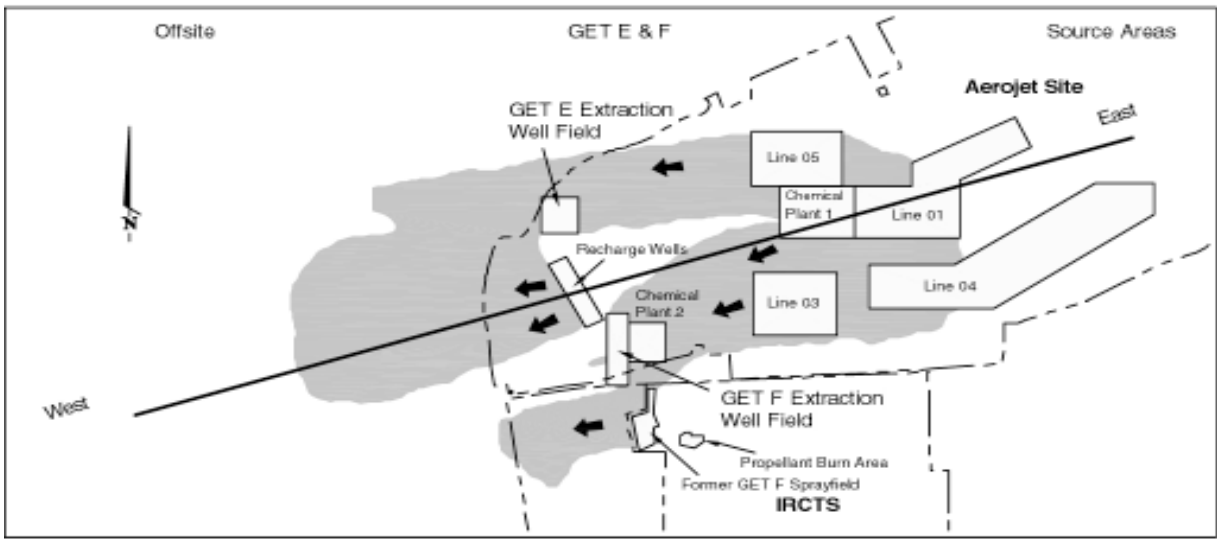
2.5.4 *Sampling Strategy*: Aerojet began installing monitor wells in OU-3 area in 1979. The first wells were installed at or near potential source sites east of OU-3 to evaluate whether chemicals had reached groundwater. From 1980 to 1991, after confirmation of groundwater contamination, Aerojet installed a series of monitor wells down-gradient of the source areas and along its property boundaries. In the mid to late 1980s, Aerojet constructed GETs E and F near its northwestern and southwestern property boundaries. Monitor wells were installed to measure GET effectiveness and for groundwater characterization and monitoring during the remedial investigation.

In 1997, using an improved perchlorate detection method, perchlorate was detected in several public water supply wells. Aerojet collected samples from 36 public water supply wells and nine private wells. Aerojet installed a series of monitor wells to characterize the vertical and lateral extent of perchlorate west of the Aerojet Site. These wells were also used to evaluate the extent of NDMA when NDMA was discovered in GET E in 1998, and subsequently, the GET E recharge wells. GETs E and F were combined in 1999 to facilitate perchlorate and NDMA treatment.

2.5.5 *Known and Suspected Sources of Groundwater Contamination*: Since the early 1950s, the Aerojet Sacramento site has been devoted to the development of rocket propulsion systems to support national defense, space exploration, and satellite deployment activities. Industrial activities at the Aerojet Site have included solid rocket motor manufacturing and testing, liquid rocket engine manufacturing and testing, and chemical manufacturing. Chemicals used in the manufacturing and testing areas on the Aerojet Site have included chlorinated solvents, propellants, metals, oxidizers, and a variety of chemicals produced in the chemical operations areas. Aerojet operating facilities on the western side of Aerojet include Chemical Plants 1 and 2, Manufacturing lines 1, 3, 4, and 5. GETs E and F were constructed in the mid 80's to contain and treat VOC contamination on the western side of Aerojet. GETs E and F used reinjection fields as a component of the systems. As a result, perchlorate was reinjected back into the aquifer at GETs E and F; and NDMA was reinjected at GET E. On the IRCTS property, a spray field was operated from December 1984 to February 1990 and in August 1990, to treat groundwater extracted from GET F extraction Wells 4007 and 4060 (formerly GET F South) for VOCs. The sprayfield did not treat for perchlorate. The suspected sources for groundwater contaminants are shown on Figure 2-3.

2.5.6 *Types of Contamination and Affected Media:* Operations at the Aerojet Site have resulted in the discharge of COC to the vadose zone and the underlying groundwater. Although numerous types of chemicals have been used historically on the Aerojet Site, TCE, perchlorate and NDMA comprise the chemicals that are the most prevalent and of main concern in this operable unit. TCE was utilized on the Aerojet Site for cleaning and degreasing purposes. Perchlorate was combined with a cation (generally ammonium or potassium) and utilized as an oxidizer in solid rocket propellants. NDMA is a semi-volatile organic compound (SVOC) that was either an impurity in hydrazine-based liquid rocket fuels or was formed as a combustion product of these fuels. Other chemicals of concern include breakdown products and contaminants of TCE, Freon, chloroform, nitrate and nitrite as indicated on the Table 2.1.





Approximate Area of Schematic
(Scale: 1" = 6,000')

EXPLANATION

Dissolved phase contaminants. Shown for illustration purposes only, does not depict contaminant type, concentration, depth, or exact location.

Conceptual Water Table

FIGURE 2-3

Sources of Contamination to OU3 Groundwater

Table 2.1
Types and Characteristics of Contaminants of Concern (COCs)

Contaminant/Abbreviation/Category	Source	Mobility	Carcinogenic
Trichloroethlene TCE/ VOC	Solvent	High	yes*
Tetrachloroethene/PCE/ VOC	Solvent	High	yes*
1,2-Dichloroethene/1,2-DCE/ VOC	Solvent/VOC degra-dation product	Very High	no+
1,1-Dichloroethene/1,1-DCE/ VOC	VOC degra-dation product	High	yes*
Vinyl Chloride/VC/ VOC	VOC degradation product	Very High	yes
1,1,2-Trichloroethane/1,1-2-TCA/ VOC	Solvent	Very High	yes*
1,2,-Dichloroethane/1,2-DCA/VOC	Solvent/VOC degra-dation product	Very High	yes*
1,1-Dichloroethane/1,1-DCA/VOC	Solvent	Very High	yes Calif.+
1,1,2-Trichloro-1,2,2-trifluoroethane /Freon 113/VOC	Refrigerant	High	no+
Chloroform/CHCl3/VOC	Solvent	Very High	yes
Carbon Tetrachloride/CCl4/VOC	Solvent	Moderate	yes*
Perchlorate/ClO4/Inorganic Anion	Oxidizer solid rocket fuel	Very High	yes @ high dose+
N-Nitrosodimethylamine/NDMA/ Semi-Volatile Organic	Impurity/combustion of liquid rocket fuel	Moderate	yes
Nitrate/NO3/Inorganic	Degradation product rocket fuel	Very High	no+
Nitrite/NO/Inorganic	Degradation product rocket fuel	Very High	no+

Key: * = also has non-cancer risks; + = has non-cancer risks; Calif. = considered carcinogen by State of California

The affected media in OU-3 is groundwater. The aquifer has six layers A through F. Layers C, D and E have been contaminated, with Layer C having approximately sixty percent of the contamination, Layer D thirty-one percent and Layer E nine percent. Layers A and B, which appear to be present primarily in the eastern portions of OU-3, are distinct in only limited areas of the western off-property area. Layer F has not been contaminated. OU-3 is located near the eastern edge of the Sacramento Valley close to

the point of contact between the Sierra Nevada metamorphic basement rocks and the valley sediments. This area is characterized by shallow-dipping (generally less than 1 degree) Cretaceous-, Tertiary-, and Quaternary-age marine and fluvial sediments overlying steeply dipping Jurassic crystalline basement rocks. The erosional surface of the basement rock dips to the west beneath OU-3 at approximately 4 degrees.

Groundwater flow directions and gradients have been studied for many years on the Aerojet Site and on the IRCTS. During the past several years, monitor wells installed in the western off-property areas have provided additional data to interpret groundwater flow in the off-property areas. Potentiometric contour maps dating from April 1991 through March 1998 were reviewed to assess temporal and seasonal trends in the groundwater flow directions. Groundwater flow in each layer is generally to the west-southwest. The potentiometric surface maps for Layer C do not show many changes in the groundwater flow directions and gradients from 1991 through 1998. Groundwater elevations in Layer C decrease from approximately 75 to -10 ft. mean sea level (msl) from east to west across the OU-3 area. The groundwater flow direction is generally west-southwest with deviations in the groundwater flow direction evident in the vicinity of the GETs E and F extraction, which are screened primarily within Layer C and to a lesser extent in Layer D. The average hydraulic gradient across OU-3 area is approximately 0.004 foot per foot (20 ft. per mile). In general, the horizontal gradient is steepest in the east and flattens to the west. The average hydraulic conductivity in the GET E area ranges from 63.5 to 145.6 ft/day, with a transmissivity of 49,000 to 156,000 gallons per day/ft. The hydraulic conductivity and transmissivity in the GET F are slightly lower because the sediments are finer.

Data collected from numerous aquifer tests in the vicinity of GETs E and F were used to confirm and refine the hydrogeologic model on the Aerojet Site. Very few aquifer tests have been conducted in the western off-property areas, and correlation between the on- and off-property hydrostratigraphic layers were based primarily on relative depths, stratigraphy, water levels, and chemical concentrations. Hydrostratigraphic Layers A and B, which appear to be present primarily in the eastern portions of OU-3, are distinct in only limited areas of the western off-property area. Layers C, D and E appear to be regional features and are more easily correlated between the on- and off-property areas. The cross-section of OU-3 has interbedded sands and clay/silt that result in some discontinuous water bearing layers. With 60% of the contamination, Layer C is the first hydrostratigraphic layer that is continuous across OU-3. Layer C is composed predominantly of sand, sandstone, and minor gravel with varying degrees of cementation. Thin (1 to 10 ft.) interbeds of brown siltstone and clay are common. The depth to Layer C ranges from approximately 80 ft. in eastern part of OU-3, to approximately 180 ft. in the west. Layer C ranges in thickness from 50 to 125 ft., with an average thickness of approximately 80 ft. and a southwesterly dip of approximately 1 degree. It is saturated and continuous throughout the OU-3 area. It is separated from Layer B by an aquitard that ranges from tens of feet to over 100 ft. in thickness and from Layer D by a 10 to 45

foot thick clay and siltstone layer.

2.5.7 *Location of Contamination and Potential Routes of Migration:* Monitor wells in OU-3 were screened in the most permeable portions of the aquifer on the premise that the permeable units would act as preferential groundwater and contaminant pathways. These wells have provided the data necessary to construct a reasonably accurate assessment of the lateral and vertical extent of COC.

Over 40 public and domestic water supply wells (PWSWs) are located within the OU-3 west of Aerojet and IRCTS (see Figure 2-4). Aerojet collects water quality samples from 36 public water supply wells and nine private wells pursuant to the provisions in Exhibit IV of the PCD. Water quality data collected from the PWSWs were posted on the chemical isoconcentration maps for informational purposes and were not used for contouring because these wells are screened over several water-bearing layers.

The distribution of COC in the OU-3 area are strongly influenced by the locations of the source areas, the direction of groundwater flow, and the operations of GETs E and F. Figure 2-4 presents a conceptual model depicting the migration of COC from the Aerojet Site to the western off-property groundwater in Layers C, D and E. Dissolved COC have generally migrated from source areas located east of OU-3 area toward GETs E and F and have also been reinjected through incomplete treatment at GETs E and F. Perchlorate and NDMA are now treated at the combined GET E/F thereby eliminating the GET facility as a source for the contamination. Perchlorate is the predominant contaminant in OU-3 and has been detected in Layer C up to 9,000 ft. west of the western Aerojet perimeter.

Because the extent of contamination is greatest in Layer C (sixty percent), this layer has been selected as a representative layer for the extent of contamination. VOCs were analyzed in groundwater samples collected from over 150 monitor wells screened in Layer C from January 1996 through December 1998. Four VOCs (TCE, 1,1-DCE, 1,2-DCA and chloroform) were most recently detected above USEPA and CADHS primary Maximum Contaminant Levels (MCLs) and two VOCs (1,2-DCE and carbon tetrachloride) exceeded the CADHS primary MCL.

2.5.8.1 *Layer C - Distribution of TCE:* Previous investigations reported TCE concentrations up to 5,000 ug/L in the eastern portion of OU-3 area near source areas (i.e., Lines 03, 05, and Chemical Plant 1) located on the Aerojet Site (Aerojet/Hydro-Search, 1996). Most of the wells located in the source areas were not sampled within the sampling period. TCE was detected up to 1,000 ug/L in the vicinity of the GET E extraction wells. TCE concentrations in the vicinity of the GET F extraction wells are higher, generally ranging from 1,000 to 6,000 ug/L.

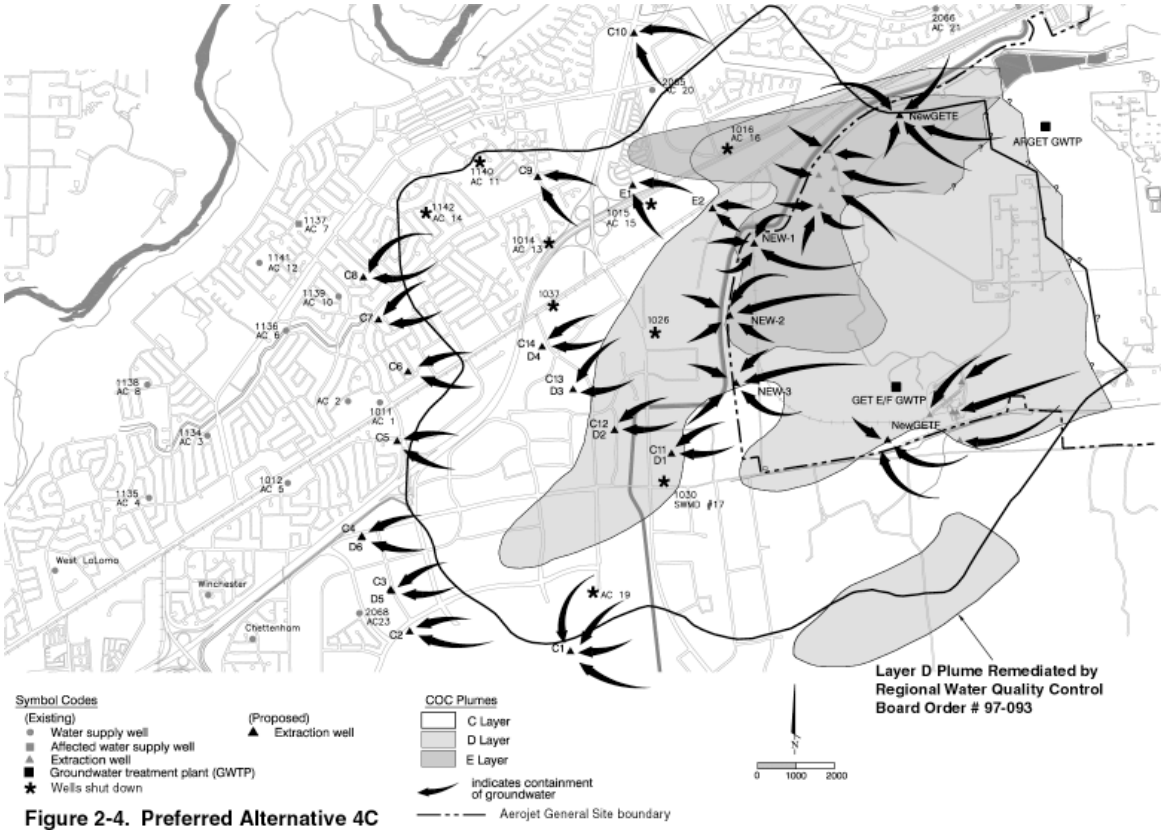


Figure 2-4. Preferred Alternative 4C

TCE concentrations off-property and down-gradient of GETs E and F are substantially lower than those observed on the Aerojet Site. TCE is present off-property to the north of GET E and extends southwest to Zinfandel Drive. In this area, TCE was detected in four public water supply wells at concentrations ranging from 1.2 to 97 ug/L.

TCE was detected above the MCL in 11 monitor wells at eight locations down-gradient of the extraction wells near the western Aerojet boundary and south of the northwestern edge of the IRCTS. The majority of TCE in this area is generally confined to the Aerojet Site and IRCTS, although some TCE may have migrated just beyond the western IRCTS boundary. Potential sources of TCE for this area are outside OU-3 and include the joint propellant burn area and upgradient sources located on Aerojet.

TCE was detected at relatively low concentrations (up to 13 ug/L) southwest of GET E/F recharge wells. The TCE in this area appears to be limited in aerial and vertical extent.

In addition to TCE, four VOCs were detected above their respective MCLs in monitor wells located on the Aerojet Site. Chloroform and 1,2-DCA were detected down-gradient of Line 05/Chemical Plant 1 as far southwest as Chemical Plant 2. Both compounds were used in these areas and their detections are consistent with the identification of source sites in these areas up-gradient of OU-3. 1,2-DCE and 1,1-DCE, both potential breakdown products of TCE, were also detected down-gradient of Chemical Plant 1/Line 05 as far southwest as Chemical Plant 2. These compounds are probably the result of the biological breakdown of TCE in groundwater in this area.

2.5.8.2 *Layer C - Distribution of Perchlorate:* Perchlorate analyses were conducted on groundwater samples collected from over 150 monitor wells screened in Layer C from January 1996 through April 1999. The perchlorate detected in Layer C has the most widespread distribution of any chemical detected in any of the hydrostratigraphic layers. The mass of perchlorate in Layer C is estimated to be $1.5x10^8$ pounds.

On the eastern side of OU-3 area, perchlorate in Layer C has "stair-stepped" down from east to west through overlying Layers A and B. Perchlorate concentrations range up to 1,500 and 8,200 ug/L in the vicinity of GETs E and F, respectively. Groundwater with perchlorate was extracted from GET E and F (three extraction wells in Layer C and five in Layers C and D). Prior to 1999, the extracted groundwater was treated for VOCs only, then recharged still containing perchlorate through the seven GET E and F recharge wells into Layer C and to some extent Layer D, forming the majority of the plume observed west of the Aerojet Site. The irregular shape of the perchlorate plume in the northwestern portion of OU-3 area suggests some influence from regional groundwater pumping. The maximum lateral extent of the perchlorate down-gradient of the recharge well field extends west to approximately Zinfandel Drive.

In the area north of Folsom Boulevard, perchlorate data from the public water supply wells were evaluated to supplement the perchlorate data from monitor wells. In addition, four nested monitor wells were installed in December 1998/January 1999 to assess potential migration pathways for perchlorate and NDMA in this area. Perchlorate is present in Layers C and D in the vicinity of public water supply wells 1015/AC15 (Note: the first well number is Aerojet's well number designation followed by the Arden Cordova Water Company well number designation) and 1016/AC16. Perchlorate is present in Layer C in the vicinity of public water supply wells 1013/AC9 and 1014/AC13.

On the IRCTS, perchlorate was detected up to 2,400 ug/L in the upper portion of Layer C, within and generally down-gradient of the GET F Sprayfield and the propellant burn area. The lateral extent of perchlorate in this area is relatively well defined by off-property monitoring wells 30089-90, where only low concentrations of perchlorate were detected up to 13 ug/L. The western extent of the southern perchlorate plume in Layer C on IRCTS has not been delineated for OU-3, and is being investigated under a separate State action.

2.5.8.3 *Layer C - Distribution of NDMA:* NDMA was detected on the Aerojet Site near Line 05/Chemical Plant 1, along the northern and northwestern Aerojet Site boundaries, and in one extraction well (4140) located at GET F. NDMA was also detected off-property down-gradient of the GET E extraction and in recharge wells and in two public water supply wells.

The presence of NDMA in Layer C in the area of West Area Lake suggests NDMA has migrated downward from overlying Layers A and B where NDMA was also detected. Some of the NDMA in these layers has migrated to the GET E extraction wells and was recharged through the recharge well field. Portions of the NDMA plume north of GET E was not captured by the extraction wells resulting in the NDMA plume west of GET E.

Characterization of NDMA in the off-property areas is complicated by the very low health-based concentrations (i.e, part per trillion) and the absence of a well-defined source. The majority of NDMA in the off-property wells was detected in Layer C. Detections of NDMA at 0.034 ug/L in Well 30087 and 0.015 ug/L in public water supply well 1140/AC11 shows that NDMA has migrated westward. NDMA was also reported in two of 20 analyses on Well 1142/AC14. Nested monitor Wells 30128-30 and 30131-3 were drilled between Wells 1140/AC11 and 1142/AC14 to evaluate the layer(s) through which NDMA was migrating. NDMA was not detected in any of the six well completions (three in Layer C, one in Layer D and two in Layer E) at this location. The absence of NDMA in these wells and upgradient Well 30122-3, combined with the presence of NDMA in Wells 30137-8, 1204, 1467, suggests the NDMA is present in relatively thin lenses, within Layer C.

2.5.8.4 *Layer D - COC Summary:* Layer D contamination is approximately 4.6 square miles in area and represents approximately 31 percent of the total contamination. The main contaminant is perchlorate, extending in a narrow plume to halfway between Sunrise Boulevard and Zinfandel Avenue, with a maximum concentration off-property detected at 600 ppb. In layer D, both TCE and NDMA extend off-property slightly to the northeast with maximum detected concentrations of 15 ppb and 0.43 ppb respectively.

2.5.8.5 *Layer E - COC Summary:* Layer E contamination is approximately one square mile in area and contains approximately 9 percent of the total contamination. In layer E, only a small portion of perchlorate, TCE, and NDMA contamination extends off-property. NDMA extends the furthest in a narrow plume which does not reach Sunrise Boulevard. The maximum detected off-property concentrations are: perchlorate at 400 ppb, TCE at 220 ppb, and NDMA at 0.08 ppb.

The maximum concentrations of COCs (within the 1996-1998 time frame) in each layer of the aquifer on- and off-property are summarized in Table 2.3.

All OU-3 contaminants are present in the dissolved phase and will continue to migrate with groundwater to the west and southwest through the process of advection. Dispersion, retardation and biological degradation will affect contaminants to some degree. The estimated groundwater velocities range from 45 to 851 ft. per year. Since the groundwater velocities are relatively high, groundwater advection is the dominant process that will affect the migration of perchlorate. Perchlorate has been detected at Zinfandel Drive. Trichloroethylene's flow rate is more retarded than perchlorate but it has also reached Zinfandel Drive, but to a more limited extent than perchlorate. NDMA has not been detected as far off-property as TCE or perchlorate. NDMA extends south of Sunrise Boulevard in the area of Highway 50.

2.6 Current and Potential Future Land and Resources Uses: The Aerojet Superfund Site is designated as a Special Planning Zone (SPZ) with multiple uses from propulsion systems testing to office use. The SPZ has provision for future development under the Sacramento County Land Use Master Plan which would allow for residential use. The on-property part of OU-3 (buffer-zone land free of soil contamination but underlain by contaminated groundwater) is proposed for development as mixed residential and commercial. The land immediately adjacent to the site is entirely zoned as heavy and light industrial. The area further to the west and south of the El Dorado Freeway (Highway 50) is designated as an industrial-office park zone. The area north of Highway 50, south of the American River and west of Sunrise Boulevard is zoned approximately 90 percent residential and 10 percent commercial. The area to the east of Sunrise Boulevard, south of the American River and north of Highway 50 is approximately 40 percent industrial and 60 residential. The American River Flood Plain and the edges of the adjacent bluffs are designated as recreational zones. The Rancho Cordova area is fully developed with residential and industrial properties. It is anticipated that the current land uses will continue into the future.

The aquifer, of which OU-3 is a very small part, is extremely large and extends beyond the city of Sacramento, over 15 miles away to the west. The ten square miles of aquifer in OU-3 off Aerojet property is currently used for drinking water (Federal Groundwater Classification IIA) and demand on the aquifer is growing. The on-property portion of OU-3, approximately 4 square miles, is mostly undeveloped at present. The on-property portion of

OU-3 obtains its water from the City of Folsom, an up-gradient source that is not contaminated and presently has a reserve for growth. The need for drinking water for the on-property portion of OU-3 is expected to increase over the next 20 years as it is developed. The Sacramento area is experiencing significant growth. The contamination if not contained will continue to flow to the west contaminating more of the drinking water aquifer. Thirteen PWSW are projected to be lost in the next 25 years.

2.7 Summary of Site Risks: The aquifer, of which OU-3 is a small part, is used as a drinking water source. Present contamination exceeds both USEPA's acceptable cancer risk range and the non-cancer hazard index of one. Table 2.2 summarizes the on-property and off-property risk associated with use of groundwater in five of the six hydrostratigraphic layers. Sampling results indicate Layer F has not been impacted by COC and Layers A and B are distinct in only limited areas off-property. There are no potentially significant completed exposure pathway for ecological receptors. This ROD response action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment; and pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

2.7.1 *Summary of Human Health Risk Assessment:* The Risk Assessment assesses the human health risks from hypothetical exposure to groundwater by future residential (both adult and child) receptors if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site. Exposure pathways include ingestion, dermal contact while showering and inhalation of volatiles. Discharge to surface water on-site will comply with the substantive requirements of an NPDES Permit (See Table 2.15); discharge to surface water off-site will require an NPDES Permit.

Table 2.2 - Summaries On- and Off-Property Risk by Groundwater Layer OU-3

Hydrostratigraphic Unit	Maximum On-Property Risk[1]		Maximum Off-Property Risk[1]	
	Cancer	Non-Cancer Hazard Index[2]	Cancer	Non-Cancer Hazard Index[2]
A	9.4×10^{-3}	610	NA	NA
B	9.4×10^{-3}	1800	NA	NA
C	1.1×10^{-2}	2200	4.1×10^{-4}	670
D	5.1×10^{-3}	1600	4.3×10^{-4}	44
E	1.3×10^{-3}	46	2.5×10^{-4}	36

Key:

NA Not applicable as layers A and B are distinct in only limited areas off-property.

[1] Figures represent the maximum risk if water containing the maximum levels of each contaminant present in a layer was used.

[2] Expressed as a multiple of the Non-Cancer Hazard Index of 1.00.

2.7.1.1 *Identification of Chemical of Concern:* The maximum level of contaminants of concern in each hydrostratigraphic layer on-property and off-property was used to calculate the maximum potential risk. Table 2.3 provides the list of COC by aquifer layer and the maximum level of groundwater contamination. Figure 2-4 also shows the maximum extent of contamination in each layers and is supported by the RI/FS, Appendix B, Tables B2.1 through B2.10.

Table 2.3
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection %	Exposure Point (Pt.) Concentration	Exposure Pt. Concentration Units
		Minimum	Maximum				
On-Property Layer A	1,1,2-TCA	1.3	1.3	ug/L	13	1.3	ug/L
"	1,2- DCA	1.5	950	"	29	950	"
"	1,2-DCE	2	10	"	23	10	"
"	CHC13	2.8	230	"	26	230	"
"	PCE	0.82	0.82	"	3	0.82	"
"	TCE	3	82	"	33	82	"
"	Perchlorate	4.1	75	"	42	75	"
"	NDMA	0.019	0.16	"	24	0.16	"
"	Nitrate	0.26	219	mg/l	100	219	mg/l
"	Nitrite	0.07	22	"	38	22	"
On-Property Layer B	1,1,2-TCA	1.5	1.5	ug/l	0.5	1.5	ug/l
"	1,1- DCA	1.8	1.8	"	0.5	1.8	"
"	1,1-DCE	13	48	"	2	48	"
"	1,2-DCE	1.9	120	"	4.5	120	"
"	CC14	1.4	1.4	"	0.5	1.4	"
"	CHC13	0.78	350	"	21	350	"
"	Freon 113	1.1	1.1	"	0.5	1.1	"
"	PCE	1.2	2.1	"	1	2.1	"
"	TCE	0.51	9400	"	35	9400	"

Table 2.3
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection %	Exposure Point (Pt.) Concentration	Exposure Pt. Concentration Units
		Minimum	Maximum				
“	Perchlorate	4.1	11000	“	67	11000	“
“	NDMA	0.041	0.32	“	33	0.32	“
“	Nitrate	0.57	11	mg/l	100	11	mg/l
“	Nitrite	0.56	0.56	“	25	0.56	“
On-Property Layer C	1,1- DCA	0.67	1.3	ug/l	2	1.3	ug/l
“	1,1-DCE	0.56	63	“	7	63	“
“	1,2-DCA	0.94	160	“	3	160	“
“	1,2-DCE	0.71	41	“	12	41	“
“	CC14	0.66	0.66	“	0.2	0.66	“
“	CHC13	0.53	670	“	22	670	“
“	Freon 113	0.34	5.4	“	4	5.4	“
“	PCE	0.51	5.9	“	4	5.9	“
“	TCE	0.52	5300	“	50	5300	“
“	Perchlorate	5.5	8200	“	46	8200	“
“	NDMA	0.024	0.39	“	28	0.39	“
“	Nitrate	0.16	7.8	mg/l	100	7.8	mg/l
“	Nitrite	0.08	0.08	“	7	0.08	“
On-Property Layer D	1,1- DCA	1.1	1.7	ug/l	1	1.7	ug/l
“	1,1-DCE	0.6	14	“	4	14	“
“	1,2-DCA	1.2	4.7	“	4	4.7	“
“	1,2-DCE	1.2	25	“	9	25	“
“	CHC13	0.57	460	“	17	460	“
“	Freon 113	0.32	5.4	“	5	5.4	“
“	PCE	0.6	5	“	5	5	“
“	TCE	1.1	1500	“	27	1500	“

Table 2.3
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection %	Exposure Point (Pt.) Concentration	Exposure Pt. Concentration Units
		Minimum	Maximum				
“	Perchlorate	4.7	8700	“	44	8700	“
“	NDMA	0.028	1.3	“	57	1.3	“
“	Nitrate	0.068	6.7	mg/l	67	6.7	mg/l
On-Property Layer E	Chloroform	1.6	1.6	ug/l	0.5	1.6	ug/l
“	Freon 113	1.1	1.3	“	1	1.3	“
“	TCE	0.92	84	“	17	84	“
“	Perchlorate	4.8	610	“	21	610	“
“	NDMA	0.0098	0.38	“	57	0.38	“
“	Nitrate	0.31	6.6	mg/l	10	6.6	mg/l
Off-Property Layer A	1,1-DCE	2.6	9	ug/l	22	9	ug/l
“	1,2-DCE	50	210	“	22	210	“
“	PCE	0.65	4.4	“	25	4.4	“
“	TCE	3	630	“	47	630	“
“	VC	8.4	130	“	22	130	“
“	Perchlorate	6	20	“	14	20	“
“	Nitrate	1.3	6.9	mg/l	100	6.9	mg/l
“	Nitrite	0.23	1.1	“	100	1.1	“
Off-Property Layer B	1,2-DCE	0.59	0.59	“	1	0.59	“
“	PCE	0.51	1	“	5	1	“
“	TCE	0.53	1.2	“	32	1.2	“
“	Perchlorate	4	15	“	5	15	“
“	Nitrate	1.1	28	mg/l	100	28	mg/l
“	Nitrite	1.8	2.4	“	33	2.4	“
Off-Property Layer C	1,1-DCE	1.1	3.9	ug/l	3	3.9	ug/l

Table 2.3
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection %	Exposure Point (Pt.) Concentration	Exposure Pt. Concentration Units
		Minimum	Maximum				
“	CHC13	0.66	28	“	7	28	“
“	TCE	0.6	88	“	25	88	“
“	Perchlorate	4	8700	“	51	8700	“
“	NDMA	0.061	0.25	“	25	0.25	“
“	Nitrate	0.89	12	mg/l	100	12	mg/l
“	Nitrite	0	2.6	“	26	2.6	“
Off-Property Layer D	TCE	1	15	“	18	15	“
“	1,2-DCE	23	23	“	1	23	“
“	VC	1.8	1.8	“	1	1.8	“
“	Perchlorate	4.1	600	“	22	600	“
“	NDMA	0.021	0.43	“	20	0.43	“
“	Nitrate	1.3	9.4	mg/l	71	9.4	mg/l
“	Nitrite	0.06	0.12	“	21	0.12	“
Off-Property Layer E	1,1-DCE	2.3	2.3	ug/l	2	2.3	ug/l
“	1,2-DCE	1	7.8	“	6	7.8	“
“	TCE	0.92	220	“	36	220	“
“	Perchlorate	390	400	“	15	400	“
“	NDMA	0.015	0.08	“	15	0.08	“
“	Nitrate	1	7.1	mg/l	29	7.1	mg/l

Key: ug/l = ppb, mg/l=ppm

This table presents the chemicals of concern (COC) and exposure point concentrations for each of the COCs detected in groundwater. The table includes the range of concentration detected for each COC, as well as the frequency of detection in percent. The table shows there are 15 COC of which perchlorate, NDMA and TCE are the predominant COC.

2.7.1.2 *Exposure Assessment:* Exposure pathways include ingestion, dermal contact while showering and inhalation of volatiles. It was assumed that maximum contamination levels are contained in overlapping plumes (All contaminants in a layer are summed at the maximum concentration level), which may not occur at any given well. Thus, the maximum risk may be overestimated. Average health-based concentrations were not calculated due to the complexity of the effort and the fact that the calculated risk exceeds the Superfund acceptable range.

For these calculations, it was assumed that child and adult residents may be exposed to on-property and off-property groundwater from ingestion, dermal contact while showering, and inhalation of volatile chemicals during non-ingestion groundwater use (i.e., showering, washing, bathing, cooking). The intake for the child resident scenario was based on exposure as a child for six years. The intake for the adult resident scenario was based on exposure as a child for six years and as an adult for 24 years for a total duration of 30 years. The exposure frequency was assumed to be 350 days/year. Body weights of 15 kg and 70 kg were used for the child and adult, respectively. Specific standard exposure assumptions used for each exposure route are provided below.

- Ingestion Drinking water ingestion rates recommended by USEPA (USEPA, 1991) were used (Ingestion rates of 1 liter/day for a child and 2 liter/day for an adult resident).

- Dermal Contact While Showering A total body surface area of 20,000 cm^2 was used for adult residents (USEPA, 1992). For the child resident, a total body surface area of 6,600 cm^2 was used (USEPA, 1992). An exposure time of 0.2 hours/day was used, assuming 0.2 hours per event and 1 event per day (USEPA, 1989). The dermal permeability coefficients for the organic COC in groundwater were obtained from USEPA's Dermal Exposure Assessment, Interim Guidance (USEPA, 1992).

- Inhalation of Volatiles During Non-ingestion Groundwater Use In accordance with USEPA guidance, a model presented in the Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991) was used to calculate inhalation intakes through non-ingestion water use. It should be noted that the model is meant to be applied to household non-ingestion use in general and not specifically to showering.

In accordance with USEPA guidance, indoor inhalation rates of five m^3/day and 15 m^3/day were used for the child and adult resident scenarios, respectively. These inhalation rates are daily indoor inhalation rates which take into account non-ingestion household water uses (showering, cooking, washing, etc.).

On-property there are no significant current or future potentially completed exposure pathways within OU-3. There are no known source sites in OU-3. The City of Folsom supplies up-gradient potable and non-potable water to Aerojet. The potential pathway is also remote for future hypothetical workers and owners for the portions of the main Aerojet facility that may be sold for development because institutional controls will limit access to contaminated groundwater through land use covenants and Aerojet will retain the water rights for groundwater. Construction workers excavating on-property are not anticipated to contact contaminated groundwater because the shallowest groundwater in the OU-3 area is at depth of 50 ft. bgs, well below the normal expected construction zone of 10 ft. bgs. Soil gas sampling in OU-3 did not detect vapor diffusion risk for indoor air. The potential pathway for industrial workers at GETs E/F is not complete because the treatment plant operates as a "closed system" and there is very limited potential for workers to contact the water.

There are several potentially complete exposure pathways off-property for untreated or incompletely treated contaminated groundwater. Groundwater beneath the OU-3 area is used as a source of potable and non-potable water and the pathway for human and/or ecological receptors is potentially complete if there is no treatment of the contaminated groundwater or monitoring to remove the contaminated drinking water wells from service. Aerojet, the water purveyors, and the CADHS monitor public and private water supply wells to ensure that concentrations of chemicals do not exceed acceptable health-based levels. There are no known large-scale agricultural or other uses of groundwater that could result in a potentially significant completed exposure pathway for ecological receptors. No impacts to indoor air or construction workers are likely since contaminated groundwater is even deeper off-property than on-property. There are no known seeps or artesian groundwater sources of contaminated groundwater for ecological receptors at nearby surface waters.

The treated groundwater may either be discharged directly to a drinking water system or to surface water. Any use of the treated water as drinking water shall comply with Federal Drinking water standards as well as CADHS requirements. If the treated water is discharged to surface water on-site, this discharge shall comply with the substantive requirements of an NPDES Permit (See Table 2.15); or if the discharge is off-site, it will require an NPDES Permit. Thus, under either option, there will be no potential exposure pathways.

2.7.1.3 *Toxicity Assessment:* The toxicity assessment of the COC is contained in the following Tables 2.4A through F and supported by the RI/FS Appendix B, Tables B.5.1 through 18. Due to the volume of data, the Risk Characterization Summary Tables 2.4.C through F for cancer and non-cancer are presented only for the worst layer in the aquifer, Layer C. The USEPA toxicity values, known as non-

carcinogenic reference doses and carcinogenic slope factors, are obtained from USEPA's Integrated Risk Information System (IRIS), Nation Center for Environmental Assessment (NCEA) through August 1999, and Health Effects Assessment Summary Tables (HEAST). If data are available from more than one of these sources the preference is to use IRIS first, followed by NCEA followed by HEAST.

In the case of 1,1-Dichloroethane (1,1-DCA), California EPA has developed a carcinogenic slope factor and 1,1-DCA was evaluated both as non-carcinogen (using USEPA toxicity values) and as a carcinogen (using California EPA toxicity values). The RI concluded that metals in OU-3 groundwater are naturally occurring. The maximum detected concentration of each COC from the past 2 years of groundwater monitoring was used to assess risks for on- and off-property receptors. When calculating risks for current off-site receptors, the COC list from the water supply well with the highest number of COCs was used when detected concentrations were below MCLs. The exposure point health-based concentration was conservatively assumed to be equivalent to the MCL.

Table 2.4A - Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemicals of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Perchlorate	-	-		B_2	NCEA	12/02/92
NDMA	5.1E+01	5.1E+01	day/(mg/kg)	B_2	IRIS	01/31/87
TCE	1.1E-02	1.1E-02	"	B-C	NCEA	06/87
PCE	5.2E-02	5.2E-02	"	B-C	NCEA	06/87
1,2,-DCA	9.1E-02	9.1E-02	"	B_2	IRIS	03/31/87
1,1,2-TCA	5.7E-02	5.7E-02	"	C	IRIS	03/31/87
1,1-DCA	-	-		C	IRIS	10/01/90
1,1-DCE	6.0E-01	6.0E-01	"	C	IRIS	03/31/87
Chloroform	6.1E-03	6.1E-03	"	B_2	IRIS	06/30/88
Vinyl Chloride (child/adult)	1.5E+00	1.5E+00	"	A	IRIS	08/07/00
Carbon Tetrachloride	1.3E-01	1.3E-01	"	B_2	IRIS	01/01/91

Table 2.4A - Sample Cancer Toxicity Data Summary

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Pathway: Inhalation							
Perchlorate	-		-		-	-	-
NDMA	1.4E-02	ug/m3	4.9E+01	day/(mg/kg)	B_2	IRIS	01/31/87
TCE	1.7E-06	"	6.0E-03	"	B-C	NCEA	06/87
PCE	5.7E-07	"	2.0E-03	"	B-C	NCEA	06/87
1,2,-DCA	2.6E-05	"	9.1E-02	"	B_2	IRIS	03/31/87
1,1,2-TCA	1.6E-05	"	5.6E-02	"	B_2	IRIS	02/01/94
1,1-DCA	-		-		C	IRIS	10/01/90
1,1-DCE	5.1E-05	"	1.8E-01	"	C	IRIS	03/31/87
Chloroform	2.3E-05	"	8.1E-02	"	B_2	IRIS	06/30/88
Vinyl Chloride (combined child/adult)	8.8E-06	"	3.1E-02	"	A	IRIS	08/07/00
Carbon Tetrachloride	1.5E-05	"	5.3E-02	"	B_2	IRIS	11/31/87

Key:
- = No information available
IRIS: Integrated Risk Information System, USEPA
NCEA = National Center for Environmental Assessment, USEPA
R9 PRG Table = Region 9 Preliminary Remediation Goals Table (www.epa.gov/region09/waste/sfund/prg/)

USEPA Group:
A - Human carcinogen
B1 - Probable human carcinogen-Indicates that limited human data are available
B2 - Probable human carcinogen - Indicates sufficient evidence in animals & inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of non-carcinogenicity

Summary of Toxicity Assessment

This table provides carcinogenic risk information which is relevant to the contaminants of concern in groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants.

Table 2.4B - Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

COC	Chronic/ Sub-chronic	Oral RfD Values	Oral Value Units	Dermal RfD	Dermal RfD units	Primary Target Organ	Combined Uncertain-ty/Modify-ing Factors	Sources of RfD Target Organ	Date of RfD Target Organ
Perchlorate	Chronic	1.0E-04	(mg/kg)/ day	-	(mg/kg) /day	Thyroid	1000	NCEA	12/02/92
1,1-DCA	Chronic	1.0E-01 (a)	"	1.0E-01	"	Kidney	1000	HEAST	07/97
CIS-1,2-DCE	Chronic	1.0E-02	"	1.0E-02	"	Blood	3000	HEAST	07/97
Freon 113	Chronic	3.0E+01	"	3.0E+01	"	Neuro-logical	10	IRIS	06/87
TCE	Chronic	6.0E-03	"	6.0E-03	"	Liver	1000	NCEA	06/85
PCE	Chronic	1.0E-02	"	1.0E-02	"	Liver	1000	IRIS	03/01/88
1,2,-DCA	Chronic	3.0E-02	"	3.0E-02	"	Liver	1000	NCEA	NA
1,1,2-TCA	Chronic	4.0E-03	"	4.0E-03	"	Liver	1000	IRIS	09/26/88
1,1-DCE	Chronic	0.9E-02	"	1.0E-01	"	Liver	1000	IRIS	01/31/87
Chloroform	Chronic	1.0E-02	"	1.0E-02	"	Liver	1000	IRIS	01/31/87
Carbon Tetra-chloride	Chronic	7.0E-04	"	7.0E-04	"	Liver	1000	IRIS	01/31/87
Vinyl Chloride (child/adult)	Chronic	3.0E-03	"	3.0E-03	"	Liver	30	IRIS	08/07/00
NDMA	-	-		-		-	-	-	-
Nitrate	Chronic	1.6E+00	"	-	"	Blood	1	IRIS	05/01/91
Nitrite	Chronic	1.0E-01	"	-	"	Blood	10	IRIS	01/31/87

Table 2.4B - Non-Cancer Toxicity Data Summary

Pathway: Inhalation

COC	Chronic/ Sub-chronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD units	Primary Target Organ	Combined Uncertain-ty/Modify-ing Factors	Sources RfC:RfD Target Organ	Dates
1,1-DCA	Chronic	5.0E-01	mg/m^3	1.4E-01	(mg/kg) /day	Kidney	1000	HEAST	07/97
CIS-1,2-DCE	Chronic	3.5E-02	"	1.0E-02	"	OV	OV	R9 PRG Table	11/00
Freon 113	Chronic	3.0E+01	"	8.6E+00	"	Whole Body	100	HEAST	07/97
TCE	Chronic	2.1E-02 (a)	"	6.0E-03	"	OV	OV	R9 PRG Table	11/00
PCE	Chronic	3.9E-01	"	1.1E-01	"	Liver	1000	NCEA	08/87
1,2,-DCA	Chronic	4.9E-03	"	1.4E-03	"	Liver	1000	NCEA	08/87
1,1,2-TCA	Chronic	1.4E-02 (a)	"	4.0E-03 (a)	"	OV	OV	R9 PRG Table	11/00
1,1-DCE	Chronic	3.2E-02	"	9.0E-03	"	OV	OV	R9 PRG Table	11/00
NDMA	-	-		-		-	-	-	-
Nitrate	-	-		-		-	-	-	-
Nitrite	-	-		-		-	-	-	-
Chloroform	Chronic	3.0E-04	"	8.6E-05	"	Liver	10	NCEA	12/01/97
Carbon Tetra-chloride	Chronic	2.5E-03 (a)	"	7.0E-04 (a)	"	OV	OV	R9 PRG Table	11/00
Vinyl Chloride	Chronic	1.0E-01	"	2.9E-02	"	Liver	30	IRIS	08/07/00

Key: - = No information available
(a) = Based on route-to-route extrapolation. Oral toxicity criteria was extrapolated to inhalation route based on information provided in EPA
OV= The oral value is used
IRIS = Integrated Risk Information System, USEPA
HEAST = Health Effect Assessment Summary Table
R9 PRG Table = Region Nine Preliminary Remediation Goals Table (www.epa.gov/region09/waste/sfund/prg/)
NCEA = National Center for Environmental Assessment, USEPA

Summary of Toxicity Assessment
This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in groundwater.

Table 2.4C
Risk Characterization Summary -Non-Carcinogens (Layer C Worst Layer <u>On-Property</u>)

Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Pt.	COC	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground-water (GW)	GW	Tap water	Perchlorate	Thyroid	5.8E+02	-	9.0E-01	5.8E+02
"	"	"	1,1-DCA	Kidney	4.6E-04	1.6E-03	8.0E-06	2.1E-03
"	"	"	1,2-DCE	Liver	1.6E-01	8.0E-01	3.1E-03	9.6E-01
"	"	"	Freon 113	Whole Body	6.3E-06	1.1E-04	2.1E-07	1.2E-04
"	"	"	Nitrate	Blood	1.7E-01	-	-	1.7E-01
"	"	"	Nitrite	Blood	2.8E-02	-	-	2.8E-02
"	"	"	NDMA	Whole Body	-	-	-	-
"	"	"	TCE	Liver	3.1E+01	1.6E+02	9.7E-01	1.9E+02
"	"	"	PCE	Liver	2.1E-02	9.4E-03	1.9E-03	3.2E-02
"	"	"	1,2,-DCA	Liver	1.9E-01	2.0E+01	1.9E-03	2.0E+01
"	"	"	1,1-DCE	Liver	2.5E-01	1.2E+00	7.7E-03	1.5E+00
"	"	"	CHC13	Liver	2.4E+00	1.4E+03	4.1E-02	1.4E+03
"	"	"	CC14	Liver	3.3E-02	1.7E-01	1.4E-03	2.0E-01

Key: - = Toxicity criteria not available to quantitatively address this route of exposure.

Liver Hazard Index =	1.6E+03
Blood Hazard Index =	2.0E-01
Thyroid Hazard Index =	5.8E+02

<u>Risk Characterization</u>
This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of HQs) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than one indicates the potential for adverse non-cancer effects. The estimated HI of 2.2E+03 indicates that the potential for adverse non-cancer effects could occur from exposure to contaminated groundwater.

Table 2.4D
Risk Characterization Summary -Non-Carcinogens (Layer C Worst Layer Off-Property)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Pt.	COC	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
GW	GW	Tap water	Perchlorate	Thyroid	6.1E+02	-	9.6E-01	6.1E+02
"	"	"	Nitrate	Blood	2.6E-01	-	-	2.6E-01
"	"	"	Nitrite	Blood	9.1E-01	-	-	9.1E-01
"	"	"	TCE	Liver	5.2E-01	2.6E+00	1.6E-02	3.1E+00
"	"	"	1,2,-DCA	Liver	6.6E-04	7.0E-02	6.8E-06	7.0E-02
"	"	"	1,1-DCE	Liver	1.5E-02	7.6E-02	4.8E-04	9.1E-02
"	"	"	CHC13	Liver	9.8E-02	5.7E+01	1.7E-03	5.7E+01
Key: - = Toxicity criteria not available to quantitatively address this route of exposure.							Liver Hazard Index =	6.0E+01
							Blood Hazard Index =	1.2E+00
							Thyroid Hazard Index =	6.1E+02

Risk Characterization
This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of HQs) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than one indicates the potential for adverse non-cancer effects. The estimated HI of 6.7E+02 indicates that the potential for adverse non-cancer effects could occur from exposure to contaminated groundwater.

Table 2.4E
Risk Characterization Summary - Carcinogens (Layer C Worst Layer On-Property)

Scenario Timeframe: Current (if well installed) Receptor Population: Resident Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Pt.	COC	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
GW	GW	Layer C Tap Water	Perchlorate	-	-	-	-
"	"	"	NDMA	3.0E-04	-	4.7E-07	3.0E-04
"	"	"	TCE	8.8E-04	2.4E-03	2.8E-05	3.3E-03
"	"	"	PCE	4.6E-06	8.9E-07	4.3E-07	5.9E-06
"	"	"	1,2,-DCA	2.2E-04	1.1E-03	2.3E-06	1.3E-03
"	"	"	1,1-DCE	5.7E-04	8.5E-04	1.8E-05	1.4E-03
"	"	"	1,1-DCA	1.1E-07	5.6E-07	1.9E-09	6.7E-07

Table 2.4E
Risk Characterization Summary - Carcinogens (Layer C Worst Layer <u>On-Property</u>)

Scenario Timeframe: Current (if well installed) Receptor Population: Resident Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Pt.	COC	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
"	"	"	CHC13	6.2E-05	4.1E-03	1.1E-06	4.2E-03
"	"	"	CC14	1.3E-06	2.6E-06	5.6E-08	4.0E-06
Key: - = Toxicity criteria not available to quantitatively address this route of exposure.						Total Risk =	1.1E-02

<u>Risk Characterization</u>
This table provides the risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of exposure. The estimated Total Risk of 1.1E-02 indicates that the potential for cancer effects exceeds the USEPA risk range from exposure to contaminated groundwater.

Table 2.4F
Risk Characterization Summary - Carcinogens (Layer C Worst Layer <u>Off-Property</u>)

Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Pt.	COC	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
GW	GW	Layer C Tap Water	Perchlorate	-	-	-	-
"	"	"	NDMA	1.9E-04	-	3.0E-07	1.9E-04
"	"	"	TCE	1.5E-05	6.6E-05	4.6E-07	8.6E-05
"	"	"	1,1-DCE	3.5E-05	5.3E-05	1.1E-06	8.9E-05
"	"	"	CHC13	2.6E-06	4.0E-05	4.5E-08	4.3E-05
Key - = Toxicity criteria not available to quantitatively address this route of exposure.						Total Risk =	4.1E-04

<u>Risk Characterization</u>
This table provides the risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of exposure. The estimated Total Risk of 4.1E-04 indicates that the potential for cancer effects slightly exceeds the USEPA risk range from exposure to contaminated groundwater.

2.7.1.4 *<u>Risk Characterization Assessment:</u>* Generally, the majority of the risk is due to the presence of five or fewer of the fifteen COC. Compound specific risk are summarized in Tables 2.5.A and B.

Table 2.5A - Summary of On-Property Maximum Compound-Specific Risk OU-3

Hydrostratigraphic Unit	Compound	Concentration (ug/L)	Adult Cancer Risk	Non-Cancer Hazard Index
A	1,1,2-TCA	1.3	$6.6x10^{-6}$	0.068
	1,2-DCA	950	$7.8x10^{-3}$	121
	1,2-DCE	10	NA	0.24
	CHC13	230	$1.4x10^{-3}$	470
	PCE	0.82	$8.2x10^{-7}$	0.045
	TCE	82	$5.1x10^{-5}$	2.9
	Perchlorate	75	NA	5.3
	NDMA	0.16	$1.2x10^{-4}$	NA
	Nitrate	219,000	NA	4.8
	Nitrite	22,000	NA	7.7
		Maximum Total Risk*	$9.4x10^{-3}$	610
B	1,1,2-TCA	1.5	$7.6x10^{-6}$	0.08
	1,1-DCA	1.8	$9.2x10^{-7}$	0.00085
	1,1-DCE	48	$1.1x10^{-3}$	1.1
	1,2-DCE	120	NA	2.8
	CC14	1.4	$8.4x10^{-6}$	0.43
	CHC13	350	$2.1x10^{-3}$	716
	Freon-113	1.1	NA	0.000024
	PCE	2.1	$2.1x10^{-6}$	0.011
	TCE	9,400	$5.8x10^{-3}$	332
	Perchlorate	11,000	NA	775
	NDMA	0.32	$2.5x10^{-4}$	NA
	Nitrate	11,000	NA	0.24
	Nitrite	0.56	NA	0.2
		Maximum Total Risk*	$9.4x10^{-3}$	1800
C	1,1-DCA	1.3	$6.7x10^{-7}$	0.0017
	1,1-DCE	63	$1.4x10^{-3}$	1.4
	1,2-DCA	160	$1.3x10^{-3}$	20
	1,2-DCE	41	NA	0.96
	CC14	0.66	$4.0x10^{-6}$	0.20
	CHC13	670	$4.2x10^{-3}$	1402
	Freon-113	5.4	NA	0.00011
	PCE	5.9	$5.9x10^{-6}$	0.032
	TCE	5,300	$3.3x10^{-3}$	192
	Perchlorate	8,200	NA	581
	NDMA	0.39	$3.0x10^{-4}$	NA
		Maximum Total Risk*	$1.1x10^{-2}$	2200
D	1,1-DCA	1.7	$8.8x10^{-7}$	0.003
	1,1-DCE	14	$3.2x10^{-4}$	0.82
	1,2-DCA	4.7	$3.8x10^{-5}$	0.6
	1,2-DCE	25	NA	0.6
	CHC13	460	$2.8x10^{-3}$	942
	Freon-113	5.4	NA	0.0001
	PCE	5	$5.0x10^{-6}$	0.03
	TCE	1,500	$9.4x10^{-4}$	53
	Perchlorate	8,700	NA	610
	NDMA	1.3	$1.0x10^{-3}$	NA
	Nitrate	6,700	NA	0.15
		Maximum Total Risk*	$5.1x10^{-3}$	1600

Table 2.5A - Summary of On-Property Maximum Compound-Specific Risk OU-3

Hydrostratigraphic Unit	Compound	Concentration (ug/L)	Adult Cancer Risk	Non-Cancer Hazard Index
E	CHC13	1.6	$9.9x10^{-6}$	0.034
	Freon-113	1.3	NA	0.00003
	TCE	84	$2.9x10^{-4}$	3.0
	Perchlorate	610	NA	43
	NDMA	0.38	$1.0x10^{-3}$	NA
	Nitrate	6.6	NA	0.15
		Maximum Total Risk*	$1.3x10^{-3}$	46

*Use of Calif. Office of Environmental Health and Hazard Assessment values for TCE and PCE would provide for a higher calculated risk.

Table 2.5B - Summary of Off-Property Maximum Compound-Specific Risk OU-3

Hydrostratigraphic Unit	Compound	Concentration (ug/L)	Adult Cancer Risk	Non-Cancer Hazard Index
C	1,1-DCE	3.9	$8.9x10^{-5}$	0.022
	1,2-DCE	0.56	NA	0.0071
	CHC13	28	$4.3x10^{-5}$	57
	TCE	88	$8.1x10^{-5}$	3.1
	Perchlorate	8,700	NA	611
	NDMA	0.25	$1.9x10^{-4}$	NA
	Nitrate	12,000	NA	0.26
	Nitrite	2,600	NA	0.91
		Maximum Total Risk*	$4.1x10^{-4}$	670
D	1,2-DCE	23	NA	0.53
	TCE	15	$9.4x10^{-6}$	0.53
	Perchlorate	600	NA	42
	NDMA	0.43	$3.3x10^{-4}$	NA
	VC	1.8	$9.3x10^{-5}$	NA
	Nitrate	9,400	NA	0.21
	Nitrite	120	NA	0.042
		Maximum Total Risk*	$4.3x10^{-4}$	44
E	1,1-DCE	2.3	$5.3x10^{-5}$	0.054
	1,2-DCE	7.8	NA	0.18
	TCE	220	$1.4x10^{-4}$	7.7
	Perchlorate	400	NA	28
	NDMA	0.08	$6.1x10^{-5}$	NA
	Nitrate	7,100	NA	0.16
		Maximum Total Risk*	$2.5x10^{-4}$	36

*Use of Calif. Office of Environmental Health and Hazard Assessment value for TCE would provide for a higher calculated risk.

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equations:
Risk = CDI x SF

Where: Risk = a unitless probability (e.g., $2x10^{-5}$) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as (mg/kg-day)-1

The risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess life time cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. USEPA's generally accepted risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than one indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard Index (HI) is generated by adding HQs for all chemicals of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI less than one indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than one indicates that site-related exposures may present a risk to human health. The HQ is calculated from the following equation:
Non-cancer HQ = CDI/RfD

Where: CDI = Chronic daily intake
RfD = Reference dose

The clean-up levels for the COCs for OU-3 are listed in the Table 2.14 and the rationale for these levels are as follows:

- Perchlorate: The cleanup level selected for perchlorate is 4 ppb. USEPA is in the process of establishing a RfD for perchlorate which is expected late 2001. By letter dated June 18, 1999, USEPA Office of Research and Development (ORD) provided Interim Assessment Guidance for Perchlorate which provides and RfD range of 0.0001 to 0.0005 mg/kg-day. Using standard adult parameters this RfD range translates to 4 to 18 ppb perchlorate in drinking water. The OU-3 perchlorate remediation level of 4 ppb was selected based on the following reasons: 1) the

spatial extent of the perchlorate contamination at 4 ppb vs. 40 ppb are almost equivalent (thus, extraction systems are essentially the same), 2) the biological treatment system is not concentration sensitive (the cost of perchlorate treatment to 4 or 40 ppb is essentially the same), and 3) the current toxicological studies indicate the potential for developmental and neonatal impacts from perchlorate which could result in an action level at the lower end of the no observed adverse effects level (use of infant or child parameters vs. adult parameters).

- NDMA: There is no MCL for NDMA. The CADHS has an interim action level 20 ppt which has temporarily been raised from 2 ppt. The PRG for NDMA is 1.3 ppt. NDMA is very carcinogenic and induces tumors at multiple sites in both rodents and non-rodent mammals. NDMA is one of over 100 nitrosamines, many of which have been shown to be carcinogenic by genotoxic mechanisms. There is a high cumulative risk because there are eight other carcinogens in the mix of COC. In addition there is a relative source contribution to be considered because of the presence of NDMA in our dietary intake (e.g., bacon, beer, etc.).

- Other COC: The cleanup level for the remaining COC, e.g., 11 VOCs, nitrate and nitrite are based on MCLs. However, it is expected that as a result of the treatment for perchlorate (and to some extent NDMA) the cleanup levels achieved for the remaining 11 COCs will be well below MCLs.

A certain uncertainty is inherent in risk assessments. Uncertainty exists in the exposure assessment, toxicity values, and the risk characterization. In the human health risk assessment, exposure and the toxicity assessments are the largest sources of uncertainty and variability. For the exposure assessment, there is uncertainty in risk estimates because of 1) the use of the maximum detected concentrations for all COCs in each hydrostratigraphic layer over the past 2 years of monitoring, 2) the use of upper-bound values for ingestion, inhalation, and dermal contact rates and 3) the use of default values for exposure duration that are likely to overestimate exposures.

2.7.2 *Summary of Ecological Risk Assessment:* A review of potential ecological receptors concluded there were no significant completed pathways of significance. Within OU-3 the contamination is deep below ground and contaminants do not rise to the surface or enter surface waters. The irrigation wells in OU-3 are used for watering turf areas such as stadium lawns. Any discharge of remediated groundwater to surface water on-site will meet the substantive requirements of an NPDES Permit (See Table 2.15) or if discharged off-site, it will require an NPDES Permit which will not pose a threat to ecological receptors.

2.8 Remedial Action Objectives: The Remedial Action Objectives (RAOs) for the OU are 1) Protect human health and the environment from exposure to contaminated groundwater; 2) Achieve full containment of the contaminated groundwater to minimize future migration

of contaminants until cleanup is accomplished;
3) Protect public drinking water wells through short-term and long-term contingency plans for alternative water supplies; and
4) Restore both on-property and off-property western groundwater within OU-3 to beneficial uses.

These RAOs were selected based on the following considerations:
1) The groundwater at the western part of the Aerojet Site is used as a public water supply by two water purveyors serving over 40,000 people;
2) Eight public water supply wells have already been shut down due to groundwater contamination from the Aerojet Site;
3) One private well and 13 public water supply wells are projected to be impacted by the groundwater contamination;
4) The need for the remedial action to contain contaminated groundwater at the Aerojet boundary to prevent further migration of contamination off-property due to up-gradient sources to be remediated in the future if unabated;
5) The need for the remedial action to prevent off-property migration of the groundwater contamination to prevent the further loss of drinking water wells outside OU-3 (prevent impact on a third water purveyor);
6) The need to restore the aquifer between the on- and off-property containment systems for drinking water use;
7) The need to quickly and permanently replace any further water supply wells within OU-3 that may be lost to contamination.

2.9 Description of Alternatives: The alternatives for this remedial action are assembled from screened technologies. The RI/FS presented ten alternatives as follows:

1. No action except groundwater monitoring
2A. Off-property alternate water supply with GET E/F extraction and reinjection wells
2B. Off-property alternate water supply with GET E/F extraction wells only
3A. Off-property wellhead treatment at water supply wells with GET E/F extraction and reinjection wells
3B. Off-property wellhead treatment at water supply wells with GET E/F extraction wells only
4A. New off-property extraction wells with GET E/F extraction and reinjection wells
4B. New off-property extraction wells with GET E/F extraction wells only
4C. New off-property extraction wells with optimal well placement and with GET E/F extraction wells only
5A. New off-property extraction and reinjection wells with GET E/F extraction and reinjection wells
5B. New off-property extraction and reinjection wells with GET E/F extraction wells only

Alternatives (3A through 5B) meet ARARs and have the same numeric designations assigned to them in the FS.

Subsequent to the RI/FS, field pilot studies for *in-situ* biological remediation of both perchlorate and TCE in groundwater were initiated and are currently being implemented. While *in-situ* biological remediation was not evaluated in the alternatives, initial results from Area 20 and at GET D are promising. A pilot study at GET B is pending. Various electron donors (calcium-magnesium-acetate sodium lactate) have been used to promote establishment of anaerobic conditions and to reduce groundwater redox conditions that favor reduction of perchlorate. A proprietary material is used to degrade TCE. Environmentally-acceptable end products are produced in the degradation process (perchlorate to chloride and oxygen - TCE to ethene and chloride). Further electron donors will be evaluated, as well as distribution methods and system costs. The preliminary pilot efforts suggest *in-situ* biological remediation should be further evaluated and the remedy revised in the future if the USEPA determines it is appropriate.

2.9.1 *Description of Remedy Components*:

- Alternative 1, the No-Action Alternative, will not contain the migration of the contaminated groundwater. Water supply wells will continue to be lost. Because the contamination is not contained this alternative is not protective of public health or the environment and does not comply with ARARs. This alternative is not further evaluated.

- Alternatives 2A and 2B replace lost water supplies with new sources but allow the plume to continue to migrate and further contaminate the aquifer. The difference between 2A and 2B is that Alternative 2B provides for replacement of GET E and F's reinjection field with nine extraction wells. [Note this is a consistent difference between all A and B Alternatives] Neither Alternative 2 A or 2B contains the contamination and thus, are not protective of public health or the environment and do not comply with ARARs. These alternatives are not further evaluated.

- Alternatives 3A and 3B provide wellhead treatment to water supply wells as they become contaminated. The difference between 3A and 3B is that Alternative 3B provides for replacement of GET E and F's reinjection field with nine extraction wells. Plume control occurs through the PWSWs which is not optimal since the well locations are not selected to optimize plume control. It is anticipated that to achieve effective plume control additional extraction wells will need to be installed which would make the cost of Alternatives 3A and 3B the most expensive alternatives (Alternative 3B is already the most expensive alternative).

- Alternatives 4A, 4B, and 4C are essentially pump and treat with various extraction well locations and two discharge options for the treated groundwater. The difference between Alternative 4A and the 4B and 4C Alternatives is that both Alternatives 4B and 4C provide for replacement of GET E and F's reinjection field with nine extraction wells. The difference between Alternatives 4B and 4C is that for 4C five additional wells (four

in Layer C and one in Layer E) and five of the 4B outer ring extraction wells (four in the Layer D and one in Layer E) are moved further up-gradient to prevent further contamination of Layers D and E and the extraction wells are installed earlier. Alternatives 4A and B are the least expensive of all alternatives based on 30 year present value cost, however, for 4A and 4B the 30 year present value cost do not reflect the total cost of the remedy because components are added after 30 years (See Table 2.9 Notes for details). Alternative 4C is the least expensive of all alternatives based on total undiscounted cost (cost through life of the remedy). Alternatives 4A, B and C are acceptable to the DTSC and the RWQCB, however, CADHS and the water purveyors have expressed opposition to Alternative 4A because of its retention of the on-property reinjection field.

- Alternatives 4A through 5B contemplate two options for the treated water: discharge directly to the drinking water system, or discharge to surface water. Any direct discharge to a drinking water system will require approval from the CADHS. Discharge to surface water on-site must comply with the substantive provisions of an NPDES Permit (See Table 2.15); discharge to surface water off-site will require an NPDES Permit.

- Alternatives 5A and 5B are similar to the "4-series" alternatives except that they both use seven new off-property injection wells along with off-property extraction wells to help hydraulically control the plume. The difference between Alternatives 5A and 5B is that Alternative 5B provides for replacement of GET E and F's reinjection field with nine extraction wells. There is a greater uncertainty in controlling the plume using injection wells and general opposition to injection by the CADHS and the water purveyors. Alternatives 5A and B are more expensive than Alternatives 4A and B based on 30 year present value and more expensive than 4A, B and C using total undiscounted cost. Portions of the 5A and 5B remedy are not installed in the first 30 years of the remedy (See Table 2.9 Notes for details) and are not reflected in the 30 year present value cost.

2.9.2 *Common Elements and Distinguishing features of Each Alternative*: The retained Alternatives 3A through 5B contain the following items:

- The continued operation of the combined existing GETs E and F and the installation of four additional wells to increase the effectiveness of the on-property hydraulic barrier at GET E/F.
- Groundwater treatment using liquid phase granulated carbon or UV/oxidation for VOCs, UV/oxidation for NDMA and biological reduction for perchlorate for all but 3A and 3B which use ion exchange.
- Groundwater monitoring, institutional controls and re-evaluation of containment in 2006.
- Alternatives 4A, 4B, 5A and 5B have components of the remedy installed after 30 years which are not included in the 30 yr. present value cost (See Table 2.9 Notes).

The following Table 2.6 summarizes unique elements of each of the alternatives, followed

by Table 2.7 which provides the general comparison information for each alterative.

Table 2.6 - Summary of Unique Elements of Alternatives

Alternative	Elements
3A	• Continued operation of GET E/F treatment system and extraction and recharge wells. • Existing water supply wells located off Aerojet's property will have wellhead treatment, allowing for use of the treated water as drinking water.
3B	• Shut down of GET E/F recharge wells and replacement with nine additional on-property extraction wells to maintain on-property capture at GET E/F. • Existing water supply wells located off Aerojet's property will have wellhead treatment, allowing for use of the treated water as drinking water.
4A	• Continued operation of GET E/F treatment system and extraction and recharge wells. • Installation of 30 new off-property extraction wells to create off-property hydrologic barrier. • A new groundwater treatment plant will be constructed on and/or off Aerojet's property to treat the contaminated groundwater. The treated water will either be sent directly to the water purveyors facilities or be discharged to surface water.
4B	• Shut down of GET E/F recharge wells and replacement with nine additional on-property extraction wells to maintain on-property capture at GET E/F. • Installation of 17 new off-property extraction wells to create off-property hydrologic barrier. • A new groundwater treatment plant will be constructed on and/or off Aerojet's property to treat the contaminated groundwater. The treated water will either be sent directly to the water purveyors facilities or be discharged to surface water.
4C	• Shut down of GET E/F recharge wells and replacement with nine additional on-property extraction wells to maintain on-property capture at GET E/F. • Installation of 22 new extraction wells, with D and E layer wells installed near current plume boundary. • A new groundwater treatment plant will be constructed on and/or off Aerojet's property to treat the contaminated groundwater. The treated water will either be sent directly to the water purveyors facilities or be discharged to surface water.
5A	• Continued operation of GET E/F treatment system and extraction and recharge wells. • Installation of 24 extraction wells and seven recharge wells to create off-property hydraulic barrier. • A new groundwater treatment plant will be constructed on and/or off Aerojet's property to treat the contaminated groundwater. The treated water will either be sent directly to the water purveyors facilities or be discharged to surface water.
5B	• Shut down of GET E/F recharge wells and replacement with nine additional on-property extraction wells to maintain on-property capture at GET E/F. • Installation of 11 new extraction wells and seven recharge wells to create off-property hydraulic barrier. • A new groundwater treatment plant will be constructed on and/or off Aerojet's property to treat the contaminated groundwater. The treated water will either be sent directly to the water purveyors facilities or be discharged to surface water.

The following Table 2.7 summarizes the cost of each of the alternatives; the additional groundwater flow needed for treatment to replace drinking water lost by 2023; the amount of water reinjected; the estimated time (by layer) to capture one pore volume; and the number of years to achieve RAOs. All cost estimates are based on 30 years using a 7% discount rate.

Table 2.7 - Summary of General Comparison Information for Each Alternative

Alternative	30 yr. Present Value Cost in $M	New Wells	Added Treatment Flow gpm	Replacement Drinking Water by Year 2023	Re-inject gpm	Estimated Time for One Pore Volume by Model Runs			Est. Time to Achieve RAO at 6 Pore Volumes all Layers in Years
						Layer C (60% of Plume Area)	Layer D (31% of Plume Area)	Layer E (9% of Plume Area)	
3A	97.3	4	400 gpm	none - wellhead treatment	3800	47 years	60 years	119 years	330 years
3B	119.8	13	2825 gpm	none - wellhead treatment	none	82 years	81 years	25 years	480 years
4A	94.9 to 96.8	34	9000 gpm	3400 gpm SWTP	3800	28 years	47 years	81 years	234 years
4B	96.3 to 98.2	30	7425 gpm	3400 gpm SWTP	none	48 years	52 years	141 years	348 years
4C	**109.1 to 111**	**35**	**7975 gpm**	**3400 gpm SWTP**	**none**	**44 years**	**33 years**	**31 years**	**240 years**
5A	100.5 to 102.4	35	7600 gpm	3400 gpm SWTP	8000	32 years	46 years	92 years	258 years
5B	107.7 to 109.6	31	5725 gpm	3400 gpm SWTP	2600	54 years	52 years	66 years	348 years

SWTP = Surface Water Treatment Plant | GET = Groundwater Extraction and Treatment | gpm = gallons per minute

2.10 Summary of Comparative Analysis of Remedy Alternatives: In accordance with the NCP, the alternatives were evaluated by the USEPA using the nine criteria. For an alternative to be an acceptable remedy it must pass the USEPA's two threshold criteria 1) Overall Protective of Human Health and the Environment and 2) Compliance with ARARs. Alternatives 1, 2A and 2B do not comply with the threshold criteria and are not discussed beyond the threshold criteria (Table 2.8 Comparative Analysis of Alternatives follows the text discussion**):**

2.10.1 *Overall Protection of Human Health and the Environment:* All the retained alternatives (Alternatives 3A through 5A) are protective of human health and the environment and eliminate, reduce, or control risks posed by the contamination at OU-3 through treatment and institutional controls.

2.10.2 *Compliance with ARARs:* All the retained alternatives comply with ARARs by providing various means of containing the groundwater contamination and restoring the aquifer, and replacing lost water supplies. Alternatives 3A and 3B contain and treat the groundwater contamination by adding wellhead treatment to preserve existing supply

wells as they become contaminated. Alterative 4 and 5 variations contain and treat the groundwater using new extraction wells or extraction wells with reinjection wells. Of the remaining alternatives, Alternative 4A, 4C and 5A are projected to restore the aquifer a minimum of 90 years faster than the other alternatives.

2.10.3 *Long-term Effectiveness and Permanence:* All the retained alternatives (Alternatives 3A through 5B) would permanently remove known chemicals of concern from the groundwater. It is possible, however, that when the treatment systems are turned off that residual amounts of COCs (residual risk) could remain in portions of the groundwater aquifer after RAOs and cleanup standards for these chemicals have been achieved. Some alternatives provide better long-term effectiveness than others. Alternative 4C has the least potential for residual amount of COC to remain in portions of the groundwater aquifer because it provides for the earliest containment of contamination in Layers D and E significantly reducing the extent of contamination in these Layers D and E. By reducing the extent of contamination in Layers D and E the amount of potential residual contamination is smaller. Alternatives 4B and 4C are estimated to have the least long-term risk.

All the evaluated alternatives have the ability to maintain reliable protection of human health and the environment over time. Institutional Controls for OU-3 on-property include environmental restrictions; existing CADHS regulations on operations of potable water suppliers (i.e., monitoring, sampling, shut-down of wells as necessary and approval of new well locations); and county approval of new well use permits. Aerojet will also be required to provide public notice of new well restrictions annually.

2.10.4 *Reduction of Toxicity, Mobility, or Volume Through Treatment:* All the retained alternatives equally reduce the toxicity of the chemicals of concern in the treated groundwater. Alternatives 4B and 4C would most effectively reduce the mobility of groundwater contaminants, because they use only extraction and selective placement of extraction wells for hydraulic control. Alternative 4C would contain the contamination in Layers D and E the fastest by increasing the volume of contamination that is remediated (Allowing Layers D and E contamination to reach the extent of Layer C would increase the volume of contamination that adheres to soil grains which is not economically removable with current technology.).

2.10.5 *Short-term Effectiveness:* None of the alternatives considered are truly short-term remedies. Alternative 4A is estimated to achieve remedial action objectives (RAOs) in the shortest period of time, 234 years. However, 4A as well as 3A have disadvantages under the reduction of mobility criterion, due to the continued reinjection of treated water on-site which will not be as effective as extraction only in containing the contamination. The variations of Alternative 5 have the same drawback, due to off-site reinjection. Of the alternatives that do not include reinjection, Alternative 4C achieves RAOs in 240 years or 3 percent longer than 4A, but faster than 4B by an estimated 108 years or 31 percent.

Potential danger to workers and to the environment during the implementation of Alternative 4 and 5 variations would be higher than for Alternative 3 variations because of the need to install approximately 20 additional extraction wells and additional piping to the central treatment plant. However, the Alternative 3 variations would require maintenance for a significantly longer period. Also, Alternative 3 variations might require construction of additional extraction wells to contain the contamination, since existing drinking water well locations are not optimal for plume control. In this case, short-term effectiveness of Alternative 3 variations would be little better than that of Alternative 4 and 5 variations.

2.10.6 *Implementability:* Under Alternatives 3A and 3B, no additional drinking water wells need to be installed, making these alternatives potentially easier to implement. However, wellhead treatment needs to be installed at the existing wells. There must be sufficient space at the well location to allow installation of the treatment system. This may result in removal and replacement of existing structures. The wellhead treatment for perchlorate would use ion exchange. A similar treatment system was permitted by CADHS in southern California. Since the CADHS permit is site specific, the wellhead treatment system being contemplated under these alternatives for OU-3 would need CADHS approval.

Alternatives 4A through 5B contemplate use of a biological treatment process for perchlorate, either through an on or off-property system, to treat contaminated groundwater. If the treated water will be discharged directly to the water purveyors systems to be used as drinking water, the proposed biological treatment process will need to be approved and a specific application permit obtained from CADHS. Alternative 4C implementation may be more complicated since there is a risk of contaminating Layer D (from Layer C) during implementation of the remedial action.

2.10.7 *Cost:* Tables 2.9 and 10 provides specific cost estimates for each alternative based on 30 Year Costs and the number of years to remedy completion. Costs for the variations of Alternatives 4 and 5 depend partly on whether treated water is reused directly or indirectly. Using a 30-year present-worth method, Alternative 4B ($96.3-98.2M) is the

least expensive alternative, $12.8 M or 13 percent cheaper than Alternative 4C. However, not all the remedy is installed in the first 30 years as indicated at the bottom of Table 2.9 which results in underestimating the remedy cost. Under the total undiscounted cost method, which totals the annual costs of the remedy for the entire duration until the RAOs are met, Alternative 4C is the least expensive remedy at $1,215.7 to $1,219.1M, which is $545.7M or 45 percent cheaper than Alternative 4B.

2.10.8 *State Acceptance:* The State of California's Department of Toxic Substances Control and the Regional Water Quality Control Board support both Alternative 4B and 4C, provided 4C can be implemented to prevent potential migration of Layer C contamination down to Layer D. The State agencies do not accept Alternatives 3A and 3B because they cost more than 4B and do not insure that contaminated groundwater will be contained resulting in further loss of the down-gradient aquifer and water supply wells. The State prefers Alternatives 4B and 4C to the remedies with reinjection (3A, 4A, 5A, and 5B) because of the complexity of the site hydrogeology and the potential for residual contamination.

2.10.9 *Community Acceptance*: The three local water purveyors expressed a preference for a remedy with no reinjection and expressed no preference between Alternatives 4B and C. The acceptance of Alternative 4C or 4B by the community was mixed. The main support from the community for Alternative 4C was based on completing remediation as soon as possible. Portions of the community were willing to delay the remedy completion time in favor of initial reduced traffic congestion and expressed a preference for Alternative 4B (Alternative 4C has 2 miles or 19% more piping off-property to impact roadways, however, Alternative 4C will achieve cleanup goals an estimated 108 years faster than 4B resulting in few pipe line renewals over the life of the remedy).

Table 2.8 - Comparative Analysis of Alternatives							
Criteria	3A	3B	4A	4B	4C	5A	5B
Protective	yes	yes	yes	yes	yes	yes	yes
Meet ARARs	yes	yes	yes	yes	yes	yes	yes
Long-term effective	yes	yes	yes	Potentially better	Potentially better	yes	yes
Reduction in toxicity, mobility, or volume	Reinjection control difficult	Non-optimal well locations	Reinjection control difficult	2nd best	Best	Reinjection control difficult	Reinjection control difficult
Short-term effective-ness	Reinjection control difficult	Not optimal well locations	Reinjection control difficult	2nd best	Best	Reinjection control difficult	Reinjection control difficult
Implementability	CADHS site permit required	CADHS site permit required	Direct reuse site & process permit	Direct reuse site & process permit	Direct reuse site & process permit	Direct reuse site & process permit	Direct reuse site & process permit
Cost 30 yr Present Value*	97.3M	119.8M	94.9 to 96.8M	96.3 to 98.2M	109.1 to 111M	100.5 to 102.4M	107.7 to 109.6M
Cost Total Present Value**	110.2M	133.7M	107.2 to 109.1M	106.6 to 108.5M	118.7 to 120.6M	113.1 to 115M	118.3 to 120.2M
Cost Total undid-counted at remedy complete	2,177.9M	2,994.8M	1,510.2 to 1,513.3M	1,759.7 to 1,764.8M	1,215.7 to 1219.1M	1,868.9 to 1,874M	1,919.7 to 1,923.8M
State OK	No	No	Mixed	Yes	Yes	No	No
Community OK	No	No comment	No	Mixed	Mixed	No	No

* For Alternatives 4A, 4B, 5A and 5B not all costs occur in the first 30 yrs. (See Table 2.9 Notes for details).
** The total present value is provide at remedy completion for information purposes, however, for projects over 30 years it does not adequately represent the cost to fund the remedy to completion.

Tables 2.9 and 2.10 which follow provide the detail for the alternatives by 30 year cost and by cost to remedy completion.

Table 2.9 30 Year Remedy Costs OU-3	Capital ($ million)	30 yr.[b] O&M ($ million)	30 yr. Present Value [a] ($ million)	30 yr. Undiscount-ed Cost [c] ($ million)	**Estimat-ed Duration of Remedy**
Alternative 1 - No Action	0	4.8	2.1	4.8	Indefinite
Alternative 3A – GETs E and F Extraction and Recharge Wells with Off-site Wellhead Treatment at Water Supply Wells	64.0	141.7	97.3	205.7	330 years
Alternative 3B – GETs E and B Extraction Wells within Off-site Wellhead Treatment at Water Supply Wells	78.4	160.5	119.8	238.9	480 years
Alternative 4A – GETs E and F Extraction and Recharge Wells with Off-site Extraction wells	54.1[d]	105.4[d]	89.3[d]	159.5[d]	234 years
Direct to water purveyor/Surface water discharge Cost	3.9/6.9	4.0/1.3	5.6/7.5	7.9/8.2	"
Sum Alternative 4A 30 Yr Cost Direct/Surface Water	58/61[d]	109.4/106.7[d]	94.9/96.8[d]	167.4/167.7[d]	"
Alternative 4B – GETs E&F Extraction Wells with Off-site Extraction Wells	48.1[e]	111.4[e]	90.7[e]	159.5[e]	348 years
Direct to water purveyor/Surface water discharge Cost	3.9/6.9	4.0/1.3	5.6/7.5	7.9/8.2	"
Sum Alternative 4B 30 Yr. Cost Direct/Surface Water	52/56[e]	115.4/112.7[e]	96.3/98.2[e]	167.4/167.7[e]	"
Alterative 4C – GETs E and F Extraction Wells with Off-site Extraction Wells Multi-Containment Corridors	54	122.7	103.5	176.7	240 years
Direct to water purveyor/Surface water discharge Cost	3.9/6.9	4.0/1.3	5.6/7.5	7.9/8.2	"
Sum Alternative 4C 30 Yr. Cost Direct/Surface Water	57.9/60.9	126.7/124	109.1/111	184.6/184.9	"
Alternative 5A – GETs E and F Extraction & Recharge Wells with Off-site Extraction and Recharge Wells	53.8[f]	117.4[f]	94.9[f]	171.2[f]	258 years
Direct to water purveyor/Surface water discharge Cost	3.9/6.9	4.0/1.3	5.6/7.5	7.9/8.2	"
Sum Alternative 5A 30 Yr. Cost Direct/Surface Water	57.7/60.7[f]	121.4/118.7[f]	100.5/102.4[f]	179.1/179.4[f]	"
Alternative 5B – GETs E and F Extraction Wells with Off-site Extraction and Recharge Wells	55.5[g]	121[g]	102.1[g]	176.5[g]	348 years
Direct to water purveyor/Surface water discharge Cost	3.9/6.9	4.0/1.3	5.6/7.5	7.9/8.2	"
Sum Alternative 5B 30 Yr. Cost Direct/Surface Water	59.4/62.4[g]	125/122.3[g]	107.7/109.6[g]	184.4/184.7[g]	"

NOTES: All costs estimated with an accuracy of -30% to +50%.

[a] Present-value costs based on a 7% real discount rate.

[b] 30 yr. O&M is the present-value cost of annual & periodic O&M expenditures for 30 yrs (Annual cost varies as portions of remedy are installed. In some alternatives 4A, 4B, 5A &5B have portions of remedy installed after 30 yrs. see notes d thru g).

[c] 30 yr. undiscounted costs are 1999 dollars.

[d] 4A does not reflect total cost of remedy: in 2051, 1D and 1 E layer (700 gpm) and in 2061, 4 E layer (1300 gpm) extraction wells must be installed with monitoring wells and treatment plant upgrades.

[e] 4B does not reflect total cost of remedy: in 2041, 2D and 1 E layer (900 gpm) extraction wells must be installed with monitoring wells and treatment plant upgrades.

[f] 5A does not reflect total cost of remedy: in 2051, 3 E layer (1100 gpm) and in 2061, 2 E layer (600 gpm) extraction wells must be installed with monitoring wells and treatment plant upgrades.

[g] 5B does not reflect total cost of remedy: in 2111, 1 E layer (300 gpm) extraction well must be installed with monitoring wells and treatment plant upgrades.

Table 2.10 Costs at Remedy Completion for OU-3	Capital ($ million)	Total O&M [b] at Completion ($ million)	Total Present Value [a] at Completion ($ million)	Total Undiscounted Cost [c] ($ million)	**Estimated Duration of Remedy**
Alternative 1 - No Action	0	NA	NA	0.160/year	Indefinite
Alternative 3A – GETs E and F Extraction and Recharge Wells with Off-site Wellhead Treatment at Water Supply Wells	117.2	2,060.8	110.2	2,177.9	330 years
Alternative 3B – GETs E and B Extraction Wells within Off-site Wellhead Treatment at Water Supply Wells	261.8	2,733.0	133.7	2,994.8	480 years
Alternative 4A – GETs E and F Extraction and Recharge Wells with Off-site Extraction wells (Excludes Reuse Cost)	209.9	1,248.6	101	1,458.5	234 years
Direct to water purveyor/Surface water discharge $	23.4/41.4	31.8/10.3	6.2/8.1	54.8/51.7	“
Total Alternative 4A Cost Direct/Surface Water	233.3/251.3	1,280.4/ 1,258.9	107.2/109.1	1,513.3/ 1,510.2	“
Alternative 4B – GETs E&F Extraction Wells with Off-site Extraction Wells	225.3	1,457.6	100.4	1,682.9	348 years
Direct to water purveyor/Surface water discharge $	35.2/62.1	46.4/15.3	6.2/8.1	81.5/77.4	“
Total Alternative 4B Cost Direct/Surface Water	260.5/287.4	1,504/1,472.9	106.6/108.5	1,764.8/ 1,759.7	“
Alterative 4C – GETs E and F Extraction Wells with Off-site Extraction Wells in Multiple Containment Corridors	161.4	1,002.4	112.5	1,163.7	240 years
Direct to water purveyor/Surface water discharge $	23.4/41.4	32/10.6	6.2/8.1	55.4/52	‘’
Total Alternative 4C Cost Direct/Surface	184.8/202.8	1,034.4/1013	118.7/120.6	1,219.1/ 1,215.7	“
Alternative 5A – GETs E and F Extraction and Recharge Wells with Off-site Extraction and Recharge Wells	210.7	1,605.5	106.9	1,816.2	258 years
Direct to water purveyor/Surface water discharge $	23.5/41.4	34.4/11.3	6.2/8.1	57.8/52.7	“
Total Alternative 5A Cost Direct/Surface Water	234.2/252.1	1,639.9/1,616.8	113.1/115	1,874/1,868.9	“
Alternative 5B – GETs E and F Extraction Wells with Off-site Extraction and Recharge Wells	163.5	1,678.8	112.1	1,842.3	348 years
Direct to water purveyor/Surface water discharge $	35.2/62.1	46.4/15.3	6.2/8.1	81.5/77.4	“
Total Alternative 5B Cost Direct/Surface	198.7/225.6	1,725.2/ 1,694.1	118.3/120.2	1,923.8/ 1919.7	“

2.11 Principal Threat Wastes: The “principal threat” concept is applied to the characterization of “source materials” at a Superfund site. OU-3 applies only to contaminated groundwater. Contaminated groundwater generally is not considered to be a source material but NAPLs may be viewed as source material. However, there are no known source areas or NAPLs at OU-3 and as a result principal threat waste was not considered.

2.12 Selected Remedy: Preferred Alternative

Based on current information, USEPA prefers Alternative 4C, which requires installation of new off-property extraction wells with optimal well placement and the modification of the on-property GET E/F extraction system to eliminate reinjection wells and improve contaminated groundwater capture.

Alternative 4C provides the earliest containment of the contaminated groundwater in Layers D and E and the earliest treatment of contaminated groundwater. It would restore layers D and E 31 percent faster than the next preferred alternative, Alternative 4B. Alternative 4C would also cost least over the life of the project and has the support of the State agencies.

USEPA believes Alternative 4C meets the threshold criteria and provides the best balance of tradeoffs among the alternatives. The USEPA expects the preferred alternative to satisfy the following statutory requirements of CERCLA Section121(b): (1) to be protective of human health and the environment; (2) to comply with ARARs; (3) to be cost effective; (4) to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) to satisfy the preference for treatment as a principal element.

2.12.1 *Summary of the Rationale for the Selected Remedy:* The principal factors considered in selecting Alternative 4C as the preferred remedy are 1) provides the earliest contamination containment in aquifer Layers D and E off-property, 2) reduces the amount of residual contamination which results in an increase of the overall contamination which can be removed (contamination adhering tightly to soil particle are difficult to remove with present technology), and 3) restores the aquifer an estimated 108 years or 31 percent faster than the next preferred remedy Alternative 4B. The 30 year present value cost for Alternative 4C over 4B is an additional $12.7 million or 13 percent more but not all the remedy components for Alternative 4B are installed within the first 30 years of the remedy and thus, are not included in the estimate. The undiscounted cost, which estimates remedy costs to completion, costs significantly more for Alternative 4B because of the additional time to complete the remedy.

2.12.2 *Description of the Selected Remedy:* The components for the selected remedy Alternative 4C are as follows:

2.12.2.1 Contain and treat the contaminated groundwater off-property with P&T in all contaminated layers of the aquifer within OU-3 to prevent further contamination of the aquifer.

– The first priority is to contain the contamination off-property with P&T. The groundwater contamination off-property is primarily in the Layer C although extended fingers of contamination exist in Layers D and E. If contamination is later found in Layer F, it will be included in the remediation.

– The second priority is to modify the existing GET E/F P&T to contain and remediate all groundwater contamination at the Aerojet property boundary in all layers which feed the off-property groundwater contamination and replace the existing reinjection field with extraction wells. Aerojet must demonstrate that extraction for containment in Layers A and B is not required for the on-property boundary containment system. Existing reinjection wells 4014, 5050, 5045, 5100, 5080, 5085, 5090, 5095 will be removed from service and destroyed in accordance with State requirements and replaced with extraction wells.

– The third priority is to expedite remediation of the groundwater and prevent further degradation off-property of Layers D and E. An evaluation of *in-situ* bioremediation or a combination of the P&T and *in-situ* bioremediation shall be conducted to allow the EPA to determine whether these components can be effectively and economically implemented to expedite remediation of the groundwater as a possible revision to the remedy. Unless the remedy is revised, the groundwater remediation shall be expedited through interior P&T wells (Figure 2-4 wells E2, C11 through C14 and D1 through D4).

2.12.2.2 Restore all layers of the drinking water aquifer within the Western Ground Water Operable boundary depicted on Figure 2.2 to the cleanup levels specified in Table 2.14. The RAOs and cleanup levels are not applicable on-property up-gradient of GET E/F extraction wells. The existing GET E/F extraction wells 4315 and 4007 near Chemical Plant 2 are outside the OU-3 boundary and not part of the OU. The RAOs and cleanup levels apply up-gradient of the outermost off-property boundary extraction wells and down gradient of the on-property GET E/F extraction wells within the OU-3 boundary.

2.12.2.3 Treat extracted groundwater using biological treatment for perchlorate, UV/OX for NDMA, and liquid phase granular activated carbon air stripping for residual VOCs to meet the cleanup levels. The treatment system may be located on or off Aerojet's property, subject to USEPA approval. The treated water may either be discharged directly to the drinking water system or to surface water. If the treated water will be discharged directly to the drinking water system the appropriate CADHS approval shall be obtained. If treated water will be discharged on-site it will comply with the substantive requirements of an NPDES Permit (See Table 2.15); off-site discharge will require an NPDES Permit.

2.12.2.4 The treated water may be available as drinking water. Any use of the treated water as drinking water shall comply with Federal drinking water standards as well as CADHS requirements.

2.12.2.5 Develop, implement and augment as appropriate a short-term water replacement contingency plan (SWRCP). The SWRCP shall provide for replacement, within 24 hours, of private and public drinking water and irrigation well water supplies lost within OU-3 to Aerojet contamination on an interim basis. The SWRCP shall provide the interim water replacement until the long-term water replacement contingency plan can provide permanent replacement water. The SWRCP shall replace any extraction reductions caused by implementation of the groundwater management zone. The SWRCP shall include actions to be undertaken, a work schedule and estimated costs for the work. At a minimum, the SWRCP provisions shall provide for the following:

- Replacement of a water supply well upon initial finding of contamination at the COC cleanup level for perchlorate and NDMA or at two-thirds the MCL for the other COC. Confirmation testing will be used to determine if replacement continues.

- The SWRCP shall provide for at least a two year replacement capacity for water supplies lost due to Aerojet contamination of a well or reductions in a well's operating capacity for groundwater contamination control. The two year replacement capacity evaluation shall be the greater of the following unless otherwise agreed to by the EPA:
  - The sum of the capacities of private and public water supply wells that are within 1,000 feet of the contaminated groundwater plume at the time of entry of an enforcement agreement for OU-3;

  - Fifteen percent of the capacity of private and public water supply wells within OU-3 at the time of entry of an enforcement agreement for OU-3; or

  - The sum of the modeled two year replacement capacity for public and private water supply wells, irrigation wells and capacity reductions anticipated for groundwater management zone needs.

- The short-term capacity projection shall include the time needed to bring short and long term replacement capacity on-line. The short-term replacement capacity is to be tied into the affected water purveyors distribution system in a manner acceptable to CADHS to allow for permitting of the modification. Hydraulic modeling of the distribution system shall be provided to meet CADHS requirements. The SWRCP shall provide for telemetry active operation to allow for replacement of the anticipated water supply loss within 24 hours.

- Annual revision of the SWRCP is to be prepared. The revision shall review present capacity and shall model projections for the next two years in order to provide an adequate short-term water supply until any short- and long-term additional capacity can be available for actual use.

- Except within three months of an annual revision of the SWRCP, any time a portion of the capacity is used which exceeds the projected use in the latest SWRCP by twenty percent, the SWRCP shall be updated.

2.12.2.6 Develop and implement a long-term water replacement contingency plan (LWRCP) for the permanent replacement of private and public drinking water and irrigation water supply wells which may continue to be lost due to Aerojet contamination. The LWRCP shall provide for adequate water to permanently replace water supplies that may be lost due to Aerojet contamination for the duration of the implementation of the remedy, including supplies lost due to implementation of the groundwater management zone. The initial LWRCP and subsequent revisions shall include a minimum five year planning projection of anticipated replacement demand for all of OU-3. The LWRCP shall apply to water supply wells in place at the time of a legally enforceable order or decree to implement the remediation for OU-3 and any other replacement water supply wells which become contaminated during implementation of the remedy. Excluded from the LWRCP are permanent accommodations already completed by Aerojet under the provisions of the 1989 Partial Consent Decree (Civil Action No. CIVS-86-0064-EJG) or other subsequent legal settlement agreements with private well owners or water purveyors. The LWRCP shall include actions to be undertaken, a work schedule and estimated costs for the proposed work. The plan shall provide for the following:

- The permanent replacement of a contaminated water supply well with equivalent water supply, within 18 months of confirmation sampling that the water supply well is contaminated by COC from Aerojet.

- The implementation of permanent replacement capacity to meet the LWRCP projections based on a minimum five year planning period.

- The long-term replacement capacity is to be tied into the affected water purveyors distribution system in a manner acceptable CADHS to allow for permitting of the modification. A hydraulically equivalent distribution system shall be provided with computer hydraulic modeling done to meet CADHS requirements.

- Revision of the LWRCP every five years and submission to the USEPA for approval. The revision shall review present available capacity with model

projections for permanent replacement requirements over at least the next five years and make recommendations to provide an adequate replacement water supply, detailed by well with projected date of replacement.

- Except within six months of the next five year revision of the LWRCP, any time the actual permanent water supply replacement exceeds a yearly projected use in the latest LWRCP projection by fifteen percent the LWRCP shall be updated.

2.12.2.7 Monitoring of drinking water wells, irrigation wells, up-gradient sentinel wells, plume control evaluation, and remedy verification shall be conducted as part of the existing "Groundwater Monitoring Plan for the Aerojet Site".

2.12.2.8 Creation of a groundwater management zone (GMZ) within OU-3 to maintain water levels and prevent interference with the remedy. The GMZ shall model and assess by affected aquifer layer any operational restrictions which may be required on existing private and public water supply wells and irrigation wells to prevent any adverse effect on the sphere of influence of the remedy extraction wells. The GMZ shall also establish the areas (by aquifer layer) where new wells shall not be installed to prevent adverse effect on the remedy.

2.12.2.9 Institutional Controls (ICs) that shall be implemented with this remedy which include the following:

- Sacramento County's continued review of new well drilling permit applications.

- Aerojet shall provide an annual notification in local newspapers showing the OU-3 area of groundwater contamination, the requirement for a permit for any well within OU-3 and point of contact for a permit or the equivalent electronic information format for dissemination to the local community approved by the USEPA.

- If treated groundwater discharged directly to water supply systems exceeds CADHS drinking water action levels, Aerojet shall provide written notification on each occurrence to drinking water suppliers.

- Access to groundwater on Aerojet' property within OU-3 shall be restricted. Aerojet shall prevent access to the groundwater by reserving the groundwater estate in any sale of land overlaying the contaminated groundwater. Moreover, any lease or sale of land overlaying contaminated groundwater shall be subject to the following environmental restrictions:
  - No extraction of groundwater;

- No recharge of groundwater unless and until expressly permitted in writing by the RWQCB;

- No injection into the groundwater; and

- No sustained extraction of groundwater encountered during construction without written approval by the RWQCB.

These restrictions will be implemented through a recorded declaration of Covenants and Environmental restrictions pursuant to California Civil Code Section 1471, whereby Aerojet covenants to impose these restrictions. These covenants and environmental restrictions will be binding to Aerojet's successors and assigns as covenants running with the land. The USEPA and the RWQCB will have the right to enforce these restrictions. Aerojet shall give written notice of the groundwater contamination to each buyer, lessee, renter and mortgagee of any of these lands and every lease, deed, mortgage or instrument conveying any part of these lands shall expressly provide that it is subject to this Declaration of Covenants and Environmental Restrictions.

2.12.2.10 Conduct an evaluation of *in-situ* bioremediation or a combination of P&T and *in-situ* bioremediation to allow the EPA to determine whether these components can be effectively and economically implemented to expedite remediation of the groundwater as a possible revision to the remedy.

2.12.3 *Summary of the Estimated Remedy Costs:* The estimated cost for the selected remedy Alternative 4C is provided in the following three tables (Cost Estimate Summary, Estimated Cost of Main Remedy Components, and Summary of Present Value Analysis). At the time of the ROD, the option for dispersing of the treated water (directly discharged to the drinking water system or surface water discharge) has not yet been selected. To obtain the total remedy cost, the cost for the selected discharge option must be added to the base remedy cost to provide a total remedy cost.

Table 2.11
Cost Estimate for 30 Years & Remedy Completion Summary for Selected Remedy 4C

Alterative 4C – GETs E/ F Extraction Wells with Off-Property Extraction Wells in Multiple Containment Corridors	Capital ($ million)	Total O&M [b] ($ million)	Total Undiscounted Cost [c] ($ million)	Total Present Value [a] ($ million)
30 yr. present value $ direct/surface water	57.9/60.9	126.7/124	184.6/184.9	109.1/111
Undiscounted $ direct/surface water	184.8/202.8	1034.4/1013	1219.1/1215.7	118.7/120.6

NOTE: All costs estimated with an accuracy of -30% to +50%.

[a] Present-value costs based on a 7% real discount rate and a 240-year period of analysis (e.g., project duration).

[b] Total O&M is the total present-value cost of annual and periodic operations and maintenance expenditures for the 240-year period of analysis.

[c] Total undiscounted costs are 1999 dollars for the 240-year period of analysis.

Table 2.12
Cost Estimate to Remedy Completion Main Remedy Components - GETs E/F Extraction Wells with Off-Property Extraction Wells in Multiple Containment Corridors

Description	Alternative Cost	Direct	Surface Water
CAPITAL COSTS			
Easements and land purchase, surveying	$1,084,000	$5,000	$453,000
Extraction wells, drilling and development	$8,170,000	NA	NA
Pumps, discharge piping, wiring, pump power and control, instrumentation	$2,168,000	NA	NA
Monitor wells	$1,683,000	NA	NA
Untreated groundwater piping	$10,911,000	NA	$1,370,000
Treatment facilities	$10,981,000	$955,000	$2,880,000
Discharge piping	$1,866,000	$1,705,000	NA
Subtotal (Construction)	$36,863,000	$2,665,000	$4,703,000
Contractor markup, mobilization/demobilization, insurance	$3,686,000	$267,000	$470,000
Engineering, permitting, construction management	$5,529,000	$400,000	$705,000
Regulatory oversight	$922,000	$67,000	$118,000
Estimated Project Capital Costs	$47,000,000	$3,399,000	$5,996,000
Contingency (15%)	$7,050,000	$510,000	$899,000
Total Initial Estimated Project Capital Costs	$54,050,000	$3,909,000	$6,895,000
Treatment Plant and Piping Replacement (Total 5 replacements)	$107,365,000	$19,545,000	$34,475,000
TOTAL CAPITAL COSTS	$161,415,000[d]	$23,454,000	$41,370,000
OPERATIONS AND MAINTENANCE COSTS			
Total Undiscounted O&M costs ($ million) [a]	1002.4	32.0	10.6
Total Present Value O&M costs ($ million) [b]	59.7	2.0	0.6
Total Undiscounted Cost in 1999 ($million) [c] - Capital & O&M	1,163.7[d]	55.4	52.0
Total Present Value ($ million) - Capital & O&M	112.5[d]	6.2	8.1

Notes: All costs estimated with an accuracy of -30% to +50%.

[a] Total O&M is the total present-value cost of annual and periodic operations and maintenance expenditures for the 240-year period of analysis.

[b] Present-value costs based on a 7% real discount rate and a 240-year period of analysis (e.g., project duration).

[c] Total undiscounted costs are 1999 dollars for the 240-year period of analysis.

[d] Direct or surface water costs must be added to Alternative 4C.

2.12.3.1 Uncertainty in cost Estimates: The information in these cost estimate summary tables are based on the best available information regarding the anticipated scope of the remedial alternative. For example over the next few years electrical rates may fluctuate. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative, or as new technologies are tested. Major or significant

changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference, or a ROD Amendment, as appropriate. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.12.3.2 Impact of Discount Rate on Long-Term Projects: Although it appears it is more expensive to perform Alternative 4C ($112.5 million total present value at remedy completion) than Alternative 4B ($100.4 million), this is partially due to the effect of the discount rate on the total percent value cost estimate. Using the total undiscounted cost which excludes the discount rate and sums the annual capital and maintenance costs over the total duration of the remedy the cost comparison is reversed. The total undiscounted costs per Table 2.10 for Alternative 4C ($1,163.7 million in 1999 dollars) is less than the total discounted costs of Alternative 4B ($1,682.9 million in 1999 dollars). The reversal in cost is due to the fact that the treatment plant and piping for Alternative 4B would need to be maintained and periodically replaced for 108 years more than Alternative 4C to complete the remedy.

Table 2.13 - Summary of Present Value Analysis to Remedy Completion

Year	Capital Cost	Annual Cost	Total Cost	Discount Factor	Present Value
0	$46,413,000	$1,999,200	$48,412,000	1.000	$48,400,000
1	0	$3,998,400	$3,998,400	.935	$3,700,000
2	0	$3,998,400	$3,998,400	.873	$3,500,000
3	0	$3,998,400	$3,998,400	.816	$3,300,000
4	0	$3,998,400	$3,998,400	.763	$3,100,000
5	$6,430,000	$3,998,700	$10,428,700	.712	$7,400,000
6	0	$3,998,700	$3,998,700	.666	$2,700,000
7	0	$3,998,700	$3,998,700	.623	$2,500,000
8	0	$3,998,700	$3,998,700	.582	$2,300,000
9	0	$3,998,700	$3,998,700	.544	$2,200,000
10	$573,000	$4,088,700	$4,661,700	.508	$2,400,000
11	0	$4,088,700	$4,088,700	.475	$1,900,000
12	0	$4,088,700	$4,088,700	.444	$1,800,000
13	0	$4,088,700	$4,088,700	.415	$1,700,000
14	0	$4,088,700	$4,088,700	.388	$1,600,000

Table 2.13 - Summary of Present Value Analysis to Remedy Completion					
Year	Capital Cost	Annual Cost	Total Cost	Discount Factor	Present Value
15	0	$4,088,700	$4,088,700	.362	$1,500,000
16	0	$4,088,700	$4,088,700	.339	$1,400,000
17	0	$4,088,700	$4,088,700	.317	$1,300,000
18	0	$4,088,700	$4,088,700	.296	$1,200,000
19	0	$4,088,700	$4,088,700	.277	$1,100,000
20	$573,000	$4,178,700	$4,751,700	.258	$1,200,000
21	0	$4,178,700	$4,178,700	.242	$1,000,000
22	0	$4,178,700	$4,178,700	.226	$900,000
23	0	$4,178,700	$4,178,700	.211	$900,000
24	0	$4,178,700	$4,178,700	.197	$800,000
25	0	$4,178,700	$4,178,700	.184	$800,000
26	0	$4,178,700	$4,178,700	.172	$700,000
27	0	$4,178,700	$4,178,700	.161	$700,000
28	0	$4,178,700	$4,178,700	.150	$600,000
29	0	$4,178,700	$4,178,700	.141	$600,000
30	0	$4,178,700	$4,178,700	.131	$500,000
31	0	$4,178,700	$4,178,700	.123	$500,000
32	0	$4,178,700	$4,178,700	.115	$500,000
33	0	$4,178,700	$4,178,700	.107	$400,000
34	0	$4,178,700	$4,178,700	.100	$400,000
35	0	$4,178,700	$4,178,700	.094	$400,000
36	0	$4,178,700	$4,178,700	.088	$400,000
37	0	$4,178,700	$4,178,700	.082	$300,000
38	0	$4,178,700	$4,178,700	.076	$300,000
39	0	$4,178,700	$4,178,700	.071	$300,000
40	$21,473,000	$4,178,700	$25,651,700	.067	$1,700,000
41	0	$4,178,700	$4,178,700	.062	$300,000
42	0	$4,178,700	$4,178,700	.058	$200,000
43	0	$4,178,700	$4,178,700	.054	$200,000

Table 2.13 - Summary of Present Value Analysis to Remedy Completion

Year	Capital Cost	Annual Cost	Total Cost	Discount Factor	Present Value
44	0	$4,178,700	$4,178,700	.051	$200,000
45	0	$4,178,700	$4,178,700	.048	$200,000
46	0	$4,178,700	$4,178,700	.044	$200,000
47	0	$4,178,700	$4,178,700	.042	$200,000
48	0	$4,178,700	$4,178,700	.039	$200,000
49	0	$4,178,700	$4,178,700	.036	$200,000
50	0	$4,178,700	$4,178,700	.034	$100,000
51 – 65	0	$4,178,700	$4,178,700	.032 – .012	*$100,000
Total Present Value					$112,500,000

*In year 66, present value costs are $0, in year 2081, the present value cost to replace the $21,473,000 treatment plant is $100,000; all other present value costs are zero.

2.12.4 *Expected Outcomes of the Selected Remedy:* The expected outcomes of the Selected Remedy is the restoration of the aquifer to beneficial use (drinking water source) after cleanup levels are achieved in an estimated 240 years. Final cleanup levels for groundwater are provided in Table 2.14.

Table 2.14 Cleanup Levels for Chemicals of Concern (COC)

COC	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup Level
Perchlorate	4.0 ppb[1]	Low end of ORD range	Non-carcinogenic risk (NCR) Hazard index (HI) = 1
NDMA	1.3 ppt[2]	Preliminary Remediation Goal	Cancer risk $1x10^{-6}$
Trichloroethlene	5 ppb*	Max. Contaminant Level (MCL) USEPA & CA	Cancer risk $2.4x10^{-6}$
Tetrachloroethene	5 ppb*	MCL USEPA & CA	Cancer risk $4.7x10^{-6}$
1,1-Dichloroethane	5 ppb*	MCL CA	NCR, HI= 0.009
1,2,-Dichloroethane	0.5 ppb*	MCL CA	Cancer risk $2.9x10^{-6}$
1,1,2-Trichloroethane	5 ppb*	MCL USEPA & CA	Cancer risk $1.8x10^{-5}$
1,1-Dichloroethene	6 ppb*	MCL CA	Cancer risk $1.1x10^{-4}$
1,2-Dichloroethene	6 ppb*	MCL CA	NCR, HI = 0.3
1,1,2-Trichloro-1,2,2-trifluoroethane	1200 ppb*	MCL CA	NCR, HI = 0.03
Chloroform	100 ppb*	MCL CA	Cancer risk $4.1x10^{-4}$
Vinyl Chloride	0.5 ppb*	MCL CA	Cancer risk $2.2x10^{-5}$
Carbon Tetrachloride	0.5 ppb*	MCL CA	Cancer risk $2.3x10^{-6}$
Nitrate	10000ppb	MCL USEPA	NCR, HI = 0.4
Nitrite	1000ppb	MCL USEPA	NCR, HI = 1

Notes: [1] Low end of Office of Research and Development (ORD) guidance letter of 6/18/99
[2] The NDMA PQL is being improved. The current enforceable level is 5 ppt. Best available monitoring method technology shall be used until a PQL of 1.3 ppt is achieved.
* VOC are expected to be cleaned up to below MCLs as a result of the perchlorate and NDMA treatment.

The purpose of this response action is to control risks posed by drinking water supplies resulting in exposures from ingestion, inhalation and dermal contact. Perchlorate is the most widely distributed chemical and along with NDMA will drive the cleanup of the VOCs. While the cleanup level for VOCs are being set at the MCL level, it is anticipated that achieving the perchlorate and to some extent the NDMA cleanup levels will result in the aquifer cleanup to 10^{-6} cancer risk. The ORD 6/18/99 "Interim Assessment Guidance for Perchlorate" provides the current range of the provisional reference dose value for perchlorate as 0.0001 mg/kg-day to 0.0005 mg/kg-day issued by the National Center for Environmental Assessment (NCEA) in 1995 using standard adult parameters. The perchlorate reference dose and drinking water equivalents based on standard parameters are developed from "no observed adverse effects levels"and thus, are below the anticipated level that will cause cancer.

Table 2.15 - Effluent Limitations & Receiving Water Limitations*

Effluent Discharge Limitations

Constituents	Daily Maximum in ug/l	Monthly Average in ug/l
Volatile Organics (1	Not applicable	0.50
Perchlorate	8	4
1,4 -Dioxane	10	5
N-Nitrosodimethylamine	0.005	0.0013

(1 All volatile organic constituents listed in USEPA Method 8010 and 8020. The concentration of each constituent shall not exceed 0.5 ug/l.

(2 The discharge shall not have a pH less than 6.5 nor greater than 8.5.

(3 The 30-day average daily discharge flow shall not exceed 5.04 million gallons per day

(4 Survival of aquatic organism in 96-hour bioassays of undiluted waste shall be no less than:
Minimum for any one bioassay - - - - - - - - - 70%
Median for any three or more consecutive bioassays - - - - 90%

Receiving Water Limitations (Discharge shall not cause the following in the receiving water)

(1 Concentrations of dissolved oxygen to fall below 7.0 mg/l.

(2 Oils, greases, waxes, or other materials to form a visible film or coating on the water surface or on the stream bottom.

(3 Oils, greases, waxes, floating material (liquids, solids, foams, and scums) or suspended material to create a nuisance or adversely affect beneficial uses.

(4 Aesthetically undesirable discoloration.

(5 Fungi, slimes, or other objectionable growths.

(6 Turbidity not to increase more than 1 Natural Turbidity Units (NTUs) when natural turbidity is between 0 & 5 NTUs; increase more than 20 % when natural turbidity is between 5 & 50; increase more than 10 NTUs if the natural turbidity is between 50 & 100 NTUs; nor increase more than 10 % when the natural turbidity is greater than 100 NTUs.

(7 The normal ambient pH to fall below 6.5, exceed 8.5, nor cause the normal ambient pH to change by more than 0.5 pH units.

(8 Deposition of material that causes nuisance or adversely affects beneficial uses.

(9 The normal ambient temperature to be increased more than 5°F.

(10 Taste or odor-producing substances to impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin or to cause nuisance or adversely affect beneficial uses.

(11 Radionuclides to be present in concentrations that exceed maximum contaminant levels specified in the California Code of Regulations, Title 22; that harm human, plant, animal or aquatic life; or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life

(12 Aquatic communities and populations, including vertebrate, invertebrate, and plant species, to be degraded.

(13 Toxic pollutants to be present in the water column, sediments, or biota in concentrations that adversely affect beneficial uses; that produce detrimental response in human, plant, animal, or aquatic life; or that bioaccumulate in aquatic resources at levels which are harmful to human health.

(14 Violation of any applicable water quality standard for receiving waters adopted by the Board or the State Water Resources Control Board pursuant to the CWA and regulations adopted thereunder.

* These effluent discharge limitations may need to be supplemented in the NPDES Permit process, depending on the discharge point (Lake Natoma, Folsom South Canal or Buffalo Creek) and the receiving water (American River, Cosumness River and Mokelumne River).

2.13 Statutory Determinations:

Under its legal authorities, USEPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that during the implementation and upon completion of the selected remedial action the action, must comply with applicable or relevant and appropriate environmental standards established under federal and State environmental laws unless a waiver is justified. The selected remedy must also be cost-effective and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following section discusses how the selected remedy addresses these statutory requirements and preferences.

2.13.1 *Protection of Human Health and the Environment:* Exposure to contaminated groundwater through drinking water supplies is the area of potential risk. The selected remedy will contain the off-property contamination and treat the contamination between the on- and off-property extraction fields to drinking water standards. Exposure levels will be within the acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk and below the Hazard Index of 1 for non-carcinogens. It is expected that perchlorate and NDMA cleanup levels will drive the cleanup and result in risk levels at the lower end of the USEPA risk range. Water supply wells will be monitored and drinking water wells that will continue to be lost due to Aerojet contamination will be replaced through provision of alternative water supply. Access to contaminated groundwater will be restricted. Any sale or lease of land overlaying contaminated groundwater on Aerojet property will be subject to the following environmental restrictions: No extraction of groundwater; no recharge of groundwater unless and until expressly permitted in writing by the RWQCB; no injection; and no sustained extraction of groundwater encountered during construction expressly permitted in writing by the RWQCB. These restrictions will be implemented through a Declaration of Covenants and Environmental Restrictions, whereby Aerojet covenants to impose these restrictions.

The remedy will not have detrimental cross-media impacts. Treatment systems will comply with air quality requirements. Under direct use, treated groundwater will go directly to the water purveyors closed distribution system. Under surface water discharge on-site, the discharge will comply with the limits specified in Table 2.15; off-site discharge will require an NPDES Permit.

2.13.2 *Compliance with Applicable or Relevant and Appropriate Requirements:* Remedial actions selected under CERCLA must comply with all ARARs under federal environmental laws or, where more stringent than the federal requirements, State environmental or facility siting laws. Where a State has delegated authority to enforce a federal statute, such as RCRA, the delegated portions of the statute are considered to be a

Federal ARAR unless the State law is broader or more stringent than the federal law. Applicable or relevant and appropriate requirements are identified on a site-specific basis from information about site-specific chemicals, specific actions that are being considered, and specific features of the site location. There are three categories of ARARs: (1) chemical-specific requirements; (2) action-specific requirements; and (3) location-specific requirements. Where no ARARs exist for a given chemical, action or location, USEPA may consider non-promulgated federal or State advisories and guidance as To Be Considered criteria (TBC). Although consideration of a TBC is not required, if standards are selected based on TBC, those standards are legally enforceable as performance standards.

Chemical-specific ARARs are risk-based cleanup standards or methodologies which, when applied to site-specific conditions, result in the development of cleanup standards for COC.

Location-specific ARARs are restrictions placed on health-based concentrations of hazardous substances or the conduct of activities because of the special locations, which have important geographical, biological or cultural features. Examples of special locations include wetlands, flood plains, sensitive ecosystems and seismic areas.

Action-specific ARARs are technology-based or activity-based requirements or limitations on actions to be taken to handle hazardous wastes. They are triggered by the particular remedial activities selected to accomplish a remedy.

Table 2.16 - Description of ARARS for Selected Remedy

Authority	Medium	Requirements	Status	Synopsis of Requirements	Action to be Taken to Attain Requirements
Chemical-Specific ARARs					
Federal Regulatory Require-ment	Ground-water (GW)	Federal Safe Drinking Water Maximum Contaminant Levels (MCLs)	Relevant & Appropriate (R&A)	MCLs have been regulated for a number of common organic and inorganic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for ground-water aquifers potentially used for drinking water.	The selected remedy will comply with these requirements. The cleanup levels for the VOCs in the aquifer are set at MCLs. Where there are no MCLs for the contaminants, e.g., perchlorate and NDMA, the cleanup levels are based on risk.
State Regulatory Requirement	GW	Title 27, CCR, Section 20410, Title 23, CCR, Section 2550.6	R&A	Groundwater will be monitored according to Title 27/Title 23 regulations	Progress of the remedy will be evaluated by monitoring the water supply wells & established sentinel wells.

Table 2.16 - Description of ARARS for Selected Remedy					
Authority	**Medium**	**Requirements**	**Status**	**Synopsis of Requirements**	**Action to be Taken to Attain Requirements**
State Regulatory Requirement	GW	California Safe Drinking Water Act - Title 22, Division 4, Chapter 15, Articles 4, 5.5, and 8.	R&A	The State has promulgated MCLs for some of the COCs that are more stringent.	The cleanup level for a COC with a state MCL that is more stringent is set at the state MCL.
Federal Regulatory Requirement	GW	National Pollutant Elimination Discharge System (NPDES) Permit	Applicable	A discharge to surface water must comply with effluent and receiving water limitations.	Discharge to surface water on-site will comply with the substantive requirements of an NPDES Permit (See Table 2.15); discharge to surface water off-site will require an NPDES Permit.
Federal Regulatory Requirement	GW	US EPA Region 9 Preliminary Remediation Goals (PRGs)	Applicable as Performance Standard	USEPA has developed preliminary remediation goals that are risk-based levels that are used to screen sites that may require additional investigation or possible remediation. PRGs may also be considered in setting groundwater cleanup levels in the absence of promulgated MCLs for contaminants.	In the absence of MCLs for perchlorate and NDMA, the cleanup levels for these COCs are based on risk levels. For NDMA, the cleanup level is the PRG. For perchlorate, the cleanup level is the low end of the risk range provided in ORD's 6/18/99 "Interim Assessment Guidance for Perchlorate using standard adult parameters."
Federal Regulatory Requirement	GW	USEPA Drinking Water Health Advisories and NAS Suggested No Adverse Response Levels (SNARLs)	Applicable as Performance Standard	USEPA and the Natural Academy of Sciences (NAS) published risk values for toxicity based factors other than cancer or incremental cancer risk estimates. USEPA and NAS published risk estimates for perchlorate.	The risk values for perchlorate published by USEPA and NAS were considered in establishing the cleanup level for perchlorate at the site.
State Regulatory Requirement	GW	CA Water Code, Division 7, Section 13241, 13243, 13263(a), and 13360 (Porter-Cologne Water Quality Control Act)	Applicable	Authorizes State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB) to establish in water quality control plans water quality standards for the waters of the State/Region (surface and groundwater).	The selected remedy complies with the applicable requirements in the Central Valley Region Basin Plan.
State Regulatory Requirement	GW	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins	Applicable	Those portions of the Central Valley Region Basin Plan which set out the designated uses (i.e., beneficial uses) and the water quality criteria based upon such uses are applicable requirements.	The designated use for the aquifer at the Aerojet Site is municipal and aquatic water supply. The cleanup levels for the contaminated groundwater comply with the water quality criteria based upon such use.

Table 2.16 - Description of ARARS for Selected Remedy					
Authority	**Medium**	**Requirements**	**Status**	**Synopsis of Requirements**	**Action to be Taken to Attain Requirements**
State Regulatory Requirement	GW	SWRCB Resolution No. 88-63 (Sources of Drinking Water Policy)	Applicable	Designates all ground and surface waters of the State as drinking water except where the Total Dissolved Solids (TDS) is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.	The aquifers under the Aerojet Site have been identified as sources of drinking water.
State Regulatory Requirement	GW	SWRCB resolution 92-49 (policies and Procedures for Investigation and Cleanup and Abatement of Discharge (Water Code Section 13304 and 13307)	Applicable	Discharges must cleanup and abate the effects of discharges in a manner that promotes the attainment of either background water quality, or the best water quality that is reasonable if background water quality cannot be restored.	Groundwater at OU-3 will be cleaned up to attain best water quality that is reasonable, e.g., 4 ppb for perchlorate and 1.3ppt for NDMA and at a minimum MCLs for VOCs. However, it is expected that as a result of the treatment for perchlorate and NDMA, VOCs will be cleaned up to below MCLs.*
* The Regional Water Quality Control Board, using the requirements established in Resolution No. 92-49 and the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, would set the cleanup values for cancer causing substances for OU-3 at the incremental $1x10^{-6}$ cancer risk value and not the MCLs. However, cleanup of perchlorate to 4 ug/l and NDMA to 0.0013 ug/l will likely reduce the other COCs to below their respective incremental $1x10^{-6}$ cancer risk values.					
Location-Specific ARARs					
Federal Regulatory Requirement	Within 100-year flood-plain	40 CFR Part 6, Appendix A, Fish and Wildlife coordination Act (16 USC 661 et seq.), and 40 CFR Part 6.302	Potentially Applicable	Require avoidance of adverse effects, minimization of potential harm, and restoration and preservation of natural and beneficial values of floodplains.	Constructing groundwater treatment facilities in a 100 year flood plain will be avoided. If it cannot be avoided, the potential harm to the flood plain shall be minimized.
Federal Regulatory Requirement	Within 100-year flood-plain	40 CFR 264.18(b) and 22 CCR 66264.18(b)	Potentially Applicable	A RCRA facility located in a 100-year flood plain must be designated, constructed, operated and maintained to prevent washout of any hazardous waste by a 100-year flood	Since the treatment facilities will generate hazardous waste, any facility constructed within a 100 year flood plain shall comply with this requirement.

Table 2.16 - Description of ARARS for Selected Remedy					
Authority	**Medium**	**Requirements**	**Status**	**Synopsis of Requirements**	**Action to be Taken to Attain Requirements**
Federal Regulatory Requirement	Excavat-ion of terrain which may cause irrepar-able, harm, loss, or destruct-ion of artifacts	National Archaeological and historical Preservation Act (16 USC Section 469); 36 CFR Part 65	Potentially Applicable	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data may require actions to recover and preserve artifacts.	The proposed remedial alternatives will not alter or destroy any known prehistoric or historic archeological features west of the Aerojet Site. Areas west of the Aerojet Site are essentially completely developed. However, because there is always a possibility that buried historic or prehistoric remains could be discovered during construction, this regulation would require action to recover and preserve artifacts.
Federal Regulatory Requirement	Critical habitat upon which endanger-ed species or threaten-ed species depend	Substantive portions of the Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR Part 200 and 50 CFR Part 402 Substantive portions of the CA Endangered Species Act Substantive portions of the native Plant Protection Act	Potentially Applicable	Requires action to conserve endangered species or threatened species, including consultation with the Department of Interior, Fish and Wildlife Service.	Two endangered floral species are known to occur within Sacramento County: the Sacramento Orcutt grass (Orcuttia Viscinda) and the Boggs Lake hedge hyssop (Gratiola Heterospala). Four endangered wildlife species are expected to occur within 25 miles of the Aerojet Site: Bald Eagle, Peregrine Falcon, Giant Garter Snake, and the Valley Elderberry Longhorn Beetle. The Aerojet Site may be a habitat for the Burrowing Owl, a species of concern in CA. Any action that may impact or threaten the impact an endangered species shall comply with this requirement.
Federal Regulatory Requirement	Wetlands	40 CFR Part 6 Appendix A	Potentially applicable	Actions must be taken to avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	Could be applicable if treatment facilities are constructed off- site on a wetland. Any construction in wetland would avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.
State Regulatory Requirement	Wetlands	Fish and Game Commission Wetlands Policy (adopted 1987) included in Fish and Game Code Addenda	Could be applicable as a Performance Standard	Actions must be taken to ensure that “no net loss” of wetlands acreage or habitat value occurs. Actions must be taken to restore and enhance California’s wetland acreage and habitat value.	Any construction off-site would ensure that no net loss of wetlands or habitat value occurs.
State Regulatory Requirement	Areas affecting stream or river	Fish and Wildlife Coordination Act (16 USC 661 et seq.) And 40 CFR Part 6 Section 302	Potentially Applicable	Restrictions on diversion, channeling or other activity that modifies a stream or river and affects fish or wildlife.	Applicable if treated water will be discharged to surface water. Discharge to surface water shall comply with these restrictions.

Table 2.16 - Description of ARARS for Selected Remedy					
Authority	**Medium**	**Requirements**	**Status**	**Synopsis of Requirements**	**Action to be Taken to Attain Requirements**
Action-Specific ARARs					
Federal Regulatory Requirement	Generat-ion of waste from construct-ion & operation due remedial action selected	40 CFR Part 261 and 22 CCR Section 66261	Applicable	Establishes procedures and numeric limits for identification and management of characteristic hazardous wastes, listed hazardous wastes, and State-only (non-RCRA) hazardous wastes.	These requirements are applicable to management of waste materials generated as a result of construction of the selected remedial action or operation of a groundwater treatment plant.
Federal Regulatory Requirement	Generat-ion of waste from construct-ion & operation due remedial action selected	40 CFR Section 262.11 and 22 CCR Section 66262.11	Applicable	Requires waste generators to determine if wastes are hazardous wastes and establishes procedures for such determinations	These requirements are applicable to management of waste materials generated as a result of construction of the selected remedial action or operation of a groundwater treatment plant.
Federal Regulatory Requirement	Shipment of hazardous wastes for treatment or disposal off-site	40 CFR Section 262.34 and 22 CFR 66262.34	Potentially Applicable	Specifies maximum amounts and maximum periods for accumulation of hazardous waste on-site under generator status	These requirements are potentially applicable to management of waste materials generated as a result of construction of the remedial action and operation of any groundwater treatment plant if these waste materials are hazardous wastes.
Federal Regulatory Requirement	Discharge to inland surface water	National Toxics Rule, 40 CFR 131.36	Potentially Applicable	Establishes the appropriate aquatic and human health criteria for toxic pollutants in inland surface waters and enclosed bays and estuaries. Included in the National Rule were EPA promulgated specific criteria for certain water bodies in California.	If treated water is discharged to surface water, the discharge shall comply with these requirements.
Federal Regulatory Requirement	Discharge to inland surface water	California Toxics Rule 40 CFR 131.38	Potentially Applicable	Establishes numeric water quality criteria for priority Toxic Pollutants for inland waters in the state of California, the presence or discharge of which could reasonably be expected to interfere with maintaining designated uses.	If treated water is discharged to surface water, the discharge shall comply with these requirements.
State Regulatory Requirement	Discharge to surface water	SWB Resolution Nos. 68-16 and 92-49	Potentially Applicable	Allows for the use of mixing zones as part of a determination of whether water quality is being maintained in the receiving water.	This requirement is potentially applicable if treated water is discharged to surface water.

Table 2.16 - Description of ARARS for Selected Remedy					
Authority	**Medium**	**Requirements**	**Status**	**Synopsis of Requirements**	**Action to be Taken to Attain Requirements**
Federal Regulatory Requirement	Discharge to surface water	40 CFR Parts 122 and 125 and 23 CCR 2235 et seq.	Potentially Applicable	Establishes treatment and monitoring requirements for discharges to surface water.	Discharge to surface water on-site will comply with the substantive requirements of an NPDES Permit (See Table 2.15); discharge to surface water off-site will require an NPDES Permit.
Federal Regulatory Requirement	Storm-water manage-ment	40 CFR Part 122.26 and 23 CCR 2235 et seq.	Potentially Applicable	Establishes, monitoring, and pollutant control requirements for storm water from industrial activities	The substantive requirements would be applicable if construction activities associated with the remedial action disturb an area of 5 acres.
State Regulatory Requirement	Ground-water extraction and treatment	SWB Basin Plan (wastewater reuse policy)	Relevant and Appropriate	Requires evaluation of potential water reuse options and identifies potential reuse options that should be considered prior to disposal of treated groundwater	This policy is a relevant and appropriate in reviewing the options for reuse of the treated water.
State Regulatory Requirement	GW treat-ment waste generat-ion	27 CCR, Division 2, Subdivision 1.	Applicable	Title 27 establishes waste siting classification systems and minimum waste management standards for discharges of waste to land for treatment, storage, and disposal.	Spent GAC will be classified and handled in accordance with Title 27 requirements.
Federal Regulatory Requirement	Organic waste generat-ion into air	Article 27 Air Emission Standards for Process Vents (22 CCR 66265.1030-66265.1035).	Relevant & Appropriate	Applies to treatment, storage, and disposal facilities with process vents associated with solvent extraction or air or steam stripping operations managing RCRA hazardous wastes with organic concentrations of at least 10 ppm. These operations must reduce total organic emissions below specified device to reduce total organic emissions by 95 percent by weight.	The requirements are relevant and appropriate for groundwater extraction and air-stripping operations for the remedy.

2.13.3 *Cost-Effectiveness:* In the EPA's judgement, the Selected Remedy is cost-effective and represents a reasonable value. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." [Note: NCP Section 300.430(f)(1)(ii)(D)] This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., the alternatives are both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of remedial Alternative 4C was determined to be proportional to its costs and hence this alternative represents a reasonable value for its

cost.

Long term Alternative 4C has the least residual risk of all the alternatives because it provides for the earliest containment contamination of Layers D and E, thereby significantly reducing the extent of contamination in these layers. By reducing the extent of contamination in Layers D and E, the area for potential residual contamination is smaller. Alternative 4C effectively reduces the mobility of groundwater contaminants, because it uses only extraction and through selective placement of extraction wells for hydraulic control. Because the contamination in Layers D and E is contained, a larger volume of contamination will be remediated. Alternative 4C achieves RAOs in 240 years, 3 percent longer than 4A, but faster than 4B by an estimated 108 years or 31 percent. Using a 30-year net-present-worth method, Alternative 4C is $12.8 M or 13 percent more expensive than the next preferred, Alternative 4B. Under the total undiscounted cost method, which totals the annual costs of the remedy to completion, Alternative 4C is the least expensive remedy at $1,215.7 to $1,219.1M, which is $545.7M or 45 percent cheaper than Alternative 4B.

The selected cleanup level at the low end of ORD's Interim Guidance for Perchlorate (4 ppb vs. the high end of the range18 ppb) is appropriate at this site because there is no appreciable cost difference over the first 30 years of the remedy. The extent of the perchlorate contamination at 4 ppb vs. 40 ppb are almost equivalent, resulting in the same cost for the extraction system at these cleanup levels. The biological treatment system is not concentration sensitive; thus, the treatment cost are approximately the same.

The selected cleanup level for NDMA at 10^{-6} vs. 10^{-5} has an estimated 30-year Present Value impact of $0.9M or less than one percent of the remedy costs. The estimate is based on reducing the volume of NDMA to be treated by UV/OX through segregated piping, electrical rate of $0.78 per kilowatt-hour and interest rate of 7%. UV/OX treatment electrical consumption increases significantly with each order of magnitude reduction in the treatment level. The National Institute of Occupational Safety and Health has categorized NDMA as a potential occupational carcinogen for which no exposure threshold could be identified that would protect 100 percent of the population. The additional cost is appropriate to treat NDMA to 10^{-6} at this site because 1) there is a high cumulative risk with eight other carcinogen in the mix of COC and 2) there is a relative source contribution to be considered because of the presence NDMA in our dietary intake (e.g., bacon, beer, etc.).

2.13.4 *Utilization of Permanent Solutions and Alternative Treatment Technologies to the maximum Extent Practicable:* USEPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, USEPA has determined that the Alternative 4C provides the best balance of trade-offs in terms of the five

balancing criteria, while also considering the statutory preference for treatment as a principal element and considering State and community acceptance as outlined as follow:

- Long-term Effectiveness and Permanence: By reducing the extent of contamination in Layers D and E, the area for potential residual contamination is much smaller, thereby reducing the potential for contamination to leach from soil particle.
- Reduction of Toxicity, mobility, or Volume Through Treatment: The mobility of contamination in Layers D and E is restricted in Alternative 4C. More contamination volume is removed because the area of residual contamination is the smallest.
- Short-term Effectiveness: Alternative 4C is projected to achieve remedy completion over 100 years faster than Alternatives 3A, 3B, 4B and 5B. While the time frame is approximately the same for Alternatives 4A and 5A, Alternative 4C restores layers D and E the fastest.
- Implementability: Alternative 4C is not significantly much more complex to implement than other alternatives.
- Costs: Alternative 4C is within 13 percent of the lowest cost protective remedy Alternative 4A and cheapest when evaluated using total undiscounted cost.
- State Acceptance: DTSC and the RWQCB accepts only Alternatives 4B and 4C. The CADHS are opposed to all alternatives with reinjection.
- Community Acceptance: No alternative was clearly favored by the community. However, Alternative 4C was preferred by members of the community interested in the cleanup being implemented as expeditiously as possible.

2.13.5 *Preference for Treatment as A Principal Element:* There are no known source materials or NAPL in OU-3. The largest human health risk is exposure to contaminated groundwater supplies. The selected remedy will treat the contaminated groundwater between the on- and off-property extraction well systems to the cleanup levels. The off-property extraction system will contain the off-property contamination, preventing further contamination of the aquifer. The on-property extraction system will also contain the contaminated groundwater on-property and prevent further contamination moving off-property. The remedy provides the best reduction in volume by containing the Layer D and E contamination the earliest and preventing spreading of contamination over portions of the aquifer which cannot be fully removed.

2.13.6 *Five-Year Review Requirements:* Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining within OU-3 above levels that allow for unlimited use and unrestricted exposure, but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review will be conducted within five years of completion of the physical construction of the OU-3 remedy to ensure that the remedy is, or will be protective of human health and the environment.

2.14 Documentation of Significant Changes: In response to comments from Aerojet received on the National Remedy Review Package, the USEPA added four Layer C (C11, C12,

C13 and C14) extraction wells to the Alternative 4C to prevent contamination from migrating from Layer C to D (See Figure 2-4). The cost estimates were increased accordingly. The proposed plan fact sheet inadvertently omitted these wells but they were appropriately shown on story boards shown to the public at the two public meetings.

The Proposed Plan indicated a range of cleanup levels no higher than MCLs for VOCs with a final cleanup levels to be specified in the ROD. Groundwater at OU-3 will be cleaned up to attain best water quality that is reasonable, e.g., 4 ppb for perchlorate and 1.3 ppt for NDMA and at a minimum MCLs for VOCs although it is expected that as a result of the treatment for perchlorate and NDMA, VOCs will be cleaned up to below MCLs.

PART 3: RESPONSIVENESS SUMMARY

3.1 Stakeholder Issues and USEPA Responses

There was significant community response received at the two public meetings and provided in writing during the comment period. The comments and USEPA responses are included in the Responsiveness Summary as Appendix A of this document. Aerojet expressed a preference for Alternative 4B. The water purveyors provided no alternative preference but oppose any reinjection. The community supported completing the remedy as expeditiously as possible, however, some member of the community expressed a concern over traffic congestion which will be higher for Alternative 4C over 4B in the initial phase of the remedy.

3.2 Technical and Legal Issues

3.2.1 *Technical Issues:*

Aerojet has questioned the ability of the Selected Remedy to prevent contamination migration from the more contaminated Layer C to Layer D for the middle row of extraction wells. The USEPA review has indicated the appropriate remedial design can address the concern. Extraction wells C11 through C14 were added to the cost estimate based on particle tracking modeling to address the concern.

The NDMA PQL is being improved. The current enforceable level is 5 ppt. Best available monitoring method technology shall be used until a PQL of 1.3 ppt is achieved.

3.2.2 *Legal Issues:*

American States Water Co. has filed a lawsuit in State court against DTSC and the RWQCB and a separate lawsuit against Aerojet for the reinjection of perchlorate at GETs E and F. Three toxic torte suits are also pending against Aerojet related to it's Sacramento site.

Appendix A
USEPA Response Summary

The purpose of the Response Summary is to provide a summary of USEPA's responses to the comments USEPA received from the public on USEPA's proposed plan and administrative record for the Aerojet Superfund Site, Rancho Cordova, California. This comment period was announced on November 30, 2000 and began December 1, 2000. The comment period ended on January 30, 2001 after a 60-day comment period. USEPA held two formal public meetings on Thursday, December 7, 2000 from 7:00 p.m. to 10:00 p.m. and on Wednesday January 17, 2001 from 6:00 p.m. to 10:00 p.m. Each meeting was divided into two parts. In the first part USEPA explained its proposed remedial action and answered questions. In the second part of each meeting, USEPA received formal public comments that are addressed in this response summary. The entire proceedings of both meetings were transcribed by a court reporter and are being included in the final administrative record.

USEPA received two kinds of comments: 1) written comments received during the public comment period, and 2) formal oral comments received at USEPA's public meetings. USEPA is required by law to consider and address only those comments that are pertinent and significant to the remedial action being selected. USEPA is not required to address comments which pertain to the allocation of liability for the remedial action, nor potential enforcement actions to implement the remedial action, as these are independent of the selection of the remedial action and USEPA's proposed plan. USEPA does have the discretion to address comments with limited pertinence if doing so would nonetheless address the concern of a significant segment of the public.

USEPA is not required to re-print the comments of the commenters verbatim and may paraphrase where appropriate. In many cases in this response summary, USEPA has included large segments of the original comments. However, persons wishing to see the full text of all comments should refer to the commenter's submittal to USEPA which has been included in the administrative record.

Specific responses by USEPA are indexed for convenient reference. These indices run consecutively through the entire Response Summary, regardless of the section or commenter. Comments are shown in normal text, and USEPA's responses are shown in a different italicized type style. Section A contains responses to comments received from Aerojet; these comments and responses are numbered 1 through 134. Section B contains responses to comments from GeoTrans numbered 135 to 151. Section C contains responses to oral comments received during the December 7, 2000 public meeting, numbered 152 through 307. Section D contains responses to oral comments received during the January 17, 2001 public meeting, numbered 308 through 380. Section E contains responses to comments received by mail and by email, numbered 381 through 471.

A. Responses to Comments from Aerojet

EXECUTIVE SUMMARY

1. Aerojet-General Corporation (Aerojet) has reviewed the Proposed Plan prepared for the Western Groundwater Operable Unit (OU-3) by the United States Environmental Protection Agency – Region IX (USEPA). Aerojet agrees that implementation of a remedial action is necessary for OU-3. Aerojet agrees that further enhancements of the groundwater extraction and treatment systems (GETs E/F) located along the western boundary of the Aerojet property are appropriate to mitigate any potential offsite migration of contaminants. Aerojet also agrees that offsite downgradient containment of the leading edge of the plume is appropriate to mitigate any potential impacts associated with the existing offsite contamination. In addition, Aerojet supports well drilling restrictions and contingency planning for the provision of alternate water supplies to mitigate any potential impacts to downgradient water supplies.

   USEPA's Proposed Plan inappropriately assumes that the remedial alternatives were intended to achieve groundwater restoration. Given the estimated time frames to meet remedial action objectives (RAOs), consistent with USEPA guidance, the Western Groundwater Operable Unit Remedial Investigation/Feasibility Study (OU-3 RI/FS) approved by USEPA and the California agencies presented remedial alternatives aimed at achieving containment of the on-property and off-site plumes, not restoration. This distinction is critical to remedy selection and establishing cleanup goals.

   USEPA Response to Comment #1: The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at Federal Register 55 No. 46 page 8846, Section 300.430(A)(iii)(F) states "USEPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site." One of the beneficial uses for the groundwater is drinking water. In addition, the NCP requires compliance with Applicable or Relevant and Appropriate Requirements (ARARs). The water quality objectives and the Narrative and Numerical Standard to achieve the water quality objectives that are in the Water Board's Central Valley Region Basin Plan are ARARs. The Western Groundwater Operable Unit Feasibility Study prepared by Aerojet did not present a Technical Impracticability (TI) evaluation for the operable unit. Aerojet provided in the FS approximate percent of area captured by layers within a 25-year evaluation period to allow comparison of the remedies. The FS does not state that the goal is only containment. Containment would only be applicable if groundwater was not to be restored in accordance with a TI Waiver submitted and approved in accordance with USEPA guidance (EPA 540-R-93-080).

2. There also are several problems with the cleanup goals proposed by EPA. First, most of the goals go far beyond the level of protection required by the California Department of Health Services (DHS) for drinking water. Second, meeting these cleanup goals in many

cases will be technically impracticable and prohibitively costly. Third, these goals will require the unnecessary extraction, treatment and discharge of billions of gallons of water that otherwise meet beneficial uses, including as drinking water. Moreover, because some of the cleanup goals are below reliable detection limits, the ability and costs associated with containing and treating to these goals is unknown. Finally, many of the cleanup goals have not been promulgated by USEPA or the State of California, but instead are based on policy and guidance, and to our knowledge these goals have not been applied to any other Superfund site. CERCLA and the NCP do not authorize EPA to mandatorily impose such goals, especially where they have not been consistently applied and to do so here would be capricious and arbitrary.

USEPA Response to Comment #2: It is USEPA's assessment that perchlorate and to some extent N-Nitrosodimethylamine (NDMA) will drive the cleanup. Neither perchlorate nor NDMA has USEPA Maximum Contaminant Levels and USEPA is proposing cleanup levels within the USEPA's risk range and in accordance with the water quality objectives of the Water Board Central Valley Region's Basin Plan which is an Applicable or Relevant and Appropriate Requirement. See also Comment #16.

Cleanup technology to achieve the cleanup levels proposed presently exist. The biological treatment system for Perchlorate developed by Aerojet destroys Perchlorate to less than 4 ppb, the present method detection limit. The Perchlorate biological treatment system is not concentration sensitive and destroys Perchlorate at 400 or 40 ppb for approximately the same cost. Ultraviolet Oxidation remediation technology has been shown to effectively destroy NDMA to non-detect. The present Department of Health Service action level for NDMA is an interim action level.

The treated groundwater is to supply a growing water demand in the community.

Thus, the selection of cleanup goals are specific to the Aerojet Site and the proposed cleanup levels are within the USEPA approved risk range and are enforceable.

3. Of the alternatives presented in the OU-3 RI/FS and in EPA's Proposed Plan, Alternative 4B better meets the NCP evaluation criteria than EPA's preferred remedy, Alternative 4C (as modified by EPA). Indeed, Alternative 4C will not provide any additional protection of human health or the environment, and will cost substantially more. Moreover, the additional off-site interior extraction wells may undermine the system's ability to contain the on-property, as well as the off-site, downgradient plumes. Implementing Alternative 4C also will result in greater disruption to the surrounding community.

USEPA Response to Comment # 3: Alternative 4C does provide additional protection to the environment. Groundwater in layers D and E is better protected in Alternative 4C because this alternative minimizes the additional area that would be contaminated while the contaminants are allowed to migrate to the off-

property "containment ring wells" in Alternative 4B. In the National Oil and Hazardous Substances Pollution Contingency Plan, the plume boundaries are the compliance boundaries. Alternative 4C costs 13% more than 4B but is estimated to restore the aquifer 31% faster. Allowing D and E layer contamination to migrate to the present extent of the C layer contamination would significantly increase the area of contaminated aquifer that ultimately has to be remediated.

Implementing Alternative 4C will add approximately 2.1 miles or 19% more piping in roadways than 4B in the first few years of the remedy. However, because 4B is estimated to take 108 years longer to achieve cleanup, the service lines which are estimated to have a 40 year life will need to be replaced approximately 3 additional times more than for 4C, which will be more disruptive to the community long term.

4. Finally, it is premature at this time for EPA to dismiss the direct reuse of treated groundwater. DHS has approved three of the four treatment technologies that would allow the direct reuse of the treated groundwater, and the fourth treatment technology is currently under review by DHS. Moreover, EPA and DHS have approved of direct reuse of treated groundwater at many Superfund sites in California and elsewhere. EPA should not foreclose the State of California's discretion and jurisdiction to allow direct reuse.

USEPA Response to Comment #4: USEPA has not dismissed the direct discharge of treated groundwater to a drinking water system. The side bar on Page 5 of the Proposed Plan notes that a site treatment permit for all contaminants of concern at Aerojet has not been issued, and that the California Department of Health Services drinking water program is evaluating permitting an application in southern California of a new technology that might also work at Aerojet. USEPA is not limiting the State of California's discretion or jurisdiction to allow direct discharge of treated groundwater for drinking water use in the future.

5. Aerojet supports the phased implementation of containment Alternative 4B because it best meets the nine NCP alternative evaluation criteria. All alternate water supply alternatives (including direct reuse) should be retained. Aerojet supports cleanup goals for this Operable Unit which are protective of human health consistent with drinking water standards, are technically practicable and cost reasonable, and are consistent with cleanup goals applied at other CERCLA sites.

USEPA Response to Comment #5: Aerojet's support of 4B is noted. As explained in Response to Comment #1, allowing layers D and E to be further contaminated is not consistent with the use of the aquifer use as a drinking water source. It is USEPA's assessment that Alternative 4C best meets the nine National Oil and Hazardous Substances Pollution Contingency Plan (NCP) alternative evaluation criteria. See Response to Comment #117 NCP nine criteria.

GENERAL COMMENTS ON THE PROPOSED PLAN FOR OU-3

6. Neither Alternative 4B nor Alternative 4C, or for that matter any of the alternatives identified and evaluated in the FS or the Proposed Plan, were intended to provide for groundwater restoration but rather were developed as groundwater containment alternatives. Restoration of groundwater within OU-3 is considered to be technically impracticable within a reasonable time frame regardless of the remedial action selected by EPA. As the objective of all of the remedial actions presented in the FS and Proposed Plan are to provide on-property and off-property downgradient plume containment, it is inappropriate to select Alternative 4C over Alternative 4B solely on the basis of a perceived reduction in the estimated time for groundwater restoration. In addition, the Remedial Action Objective (RAO) of "*restoring both on- and off-property groundwater to its beneficial use*" should be eliminated since EPA's estimates suggest it is unlikely that this RAO will be achieved off-property within a reasonable time frame and on-property restoration has not been evaluated.

USEPA Response to Comment #6: For the Feasibility Study (FS) to be a containment only remedy and not restore the aquifer between the on and off-property extraction wells, Aerojet would have to have provided a justification, contained in a Technical Impracticability (TI) Waiver following OSWER 9234.2-25, October 1993 guidance. No presentation was made in the FS that restoration of groundwater was technically impracticable. The FS is also required to address Applicable or Relevant and Appropriate Requirements (ARARs) and specifically the State ARARs including the State Water Resources Control Board Central Valley Region's Basin Plan. The Basin Plan requires groundwater restoration to beneficial use unless justified through a Technical and Economic Feasibility Analysis (TEFA). No TEFA was performed in the FS.

The remedy applies to the groundwater between the on and off-property extraction wells. Contamination up-gradient of the on-property extraction wells will be addressed in future Operable Units. The FS "variations 3 through 5" alternatives perform two functions 1) containing the contamination at the toe of plume off-property and preventing further contamination from moving off Aerojet property and 2) remediating groundwater between the on-property and off-property extraction wells. The alternatives were evaluated against both criteria.

7. Evaluation of the relative time frames over which various possible remedial alternatives may restore groundwater quality certainly is a factor in considering remedial alternatives under the NCP, but aquifer restoration is not required. Specifically, the NCP (40 CFR 300.430 (a)(1)(iii)(F)) states:

"EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site. When restoration of groundwater to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction."

USEPA Response to Comment #7: The USEPA evaluated the particular circumstances specific to this Operable Unit, including California's Applicable or Relevant and Appropriate Requirements. The USEPA evaluated both containing the groundwater contamination and restoring the aquifer to beneficial use which resulted in the addition of Alternative 4C to the Feasibility Study (FS). The size of the Layer C plume, approximately nine square miles, and the complexity of the hydrogeology, make it economically imperative that the containment portion of the remedy prevent the further spread of contamination in aquifer Layers C, D and E while contributing to restoration of the overall contaminated aquifer. The proposed remedy was reviewed by the USEPA's National Review Board and the board concurred with the remedy approach.

8. Aerojet will implement technically sound, reasonable, and cost-effective measures that will address significant risks posed by groundwater contamination. However, after conducting numerous evaluations, it was determined that restoration cannot be achieved except over extremely long time frames. Even EPA acknowledges in the Proposed Plan (page 12) that "None of the alternatives considered are truly short-term remedies."

   USEPA Response to Comment #8: The USEPA agrees that aquifer restoration would take longer than desirable due to the extent of contamination but that does not alleviate the need to restore the groundwater to beneficial use if achievable. Aerojet has presented no justification for a Technical Impracticability Waiver.

9. The remedial alternatives for the Western Groundwater OU-3 that were described and evaluated in the Feasibility Study and the Proposed Plan are not groundwater restoration alternatives but rather containment remedies. These alternatives were developed with the understanding that given the circumstances of the site, groundwater restoration is technically impracticable and prohibitively costly within a reasonable time frame.

   USEPA Response to Comment #9: See Response to Comment #6.

10. Specifically, the remedial alternatives considered for OU-3 are focused on collecting and containing contaminated groundwater along the western boundary of the Aerojet property and collecting and containing offsite contamination near the downgradient end of the existing groundwater plume (i.e., approximately along Zinfandel Drive) so as to mitigate any potential impacts to offsite groundwater wells and associated water supplies. The layout of the groundwater extraction system in lines of wells perpendicular rather than parallel to the groundwater flow direction reflects the primary containment objective of the remedy rather than a more secondary and long-term goal of ultimately restoring the aquifer to beneficial uses. Although it is stated as one of the objectives of the remedial action in the Proposed Plan, restoration of groundwater beneath or downgradient of the Aerojet site is not considered to be practical within any reasonable time frame. EPA has developed criteria for evaluation of the technical practicability or impracticability of groundwater restoration (USEPA, 1993, OSWER Directive 9234.2-25). The Western Groundwater OU-3 meets many of the criteria EPA considers for "technical impracticability" of groundwater restoration including:

- The nature of the release was a large volume, continual release over a long period of time;

- The primary contaminants of concern (perchlorate and NDMA) are not readily subject to biological decay and are not volatile;

- The volume of contaminated groundwater is large and at great depth; and

- The stratigraphy of the aquifer is complex, containing discontinuous sand lenses within an extensive silt/clay matrix resulting in extremely heterogeneous conditions.

USEPA Response to Comment #10: The Feasibility Study shows that remediation of the groundwater is achievable while containing the plume. The Operable Unit does not contain Non-Aqueous Phase Liquids or source materials. See also Response to Comments #6 and #7.

11. As a result of these site/contaminant conditions, there is a high degree of uncertainty as to the ultimate restoration potential of the aquifer, particularly the portion of the aquifer on-site.

USEPA Response to Comment #11: The Feasibility Study (FS) does not provide a Technical Impracticability (TI) evaluation to support the assertion that the aquifer cannot be restored. The USEPA agrees that the site stratigraphy is complex which is why the USEPA made provision for an effectiveness adjustment in 2006. The ultimate test of the remedy will be its operational performance. Based on remedy performance data, the Remedial Action Objectives could be adjusted through a Record of Decision Amendment if appropriate. The uncertainty is minimized because the remedy does not extend up-gradient of the on-property containment field and the area to be remediated has no known sources contributing to the contamination or non-aqueous phase liquids which are difficult to cleanup.

12. Evaluations conducted by EPA as part of the development of the Proposed Plan indicate that if restoration is possible, the time frames for achieving restoration are estimated to be extremely long, regardless of the alternative selected. The projected long time frames for achieving restoration result from the hydrologic and contaminant conditions described above, along with the large area and volume of the contaminant plume and the numerous pore flushes that may be necessary to reduce the levels of contamination within the offsite portions of the aquifer.

USEPA Response to Comment #12: See Responses to Comments #6 and #7.

13. It is unclear today how many pore volumes will be required to reduce the levels of contaminants within the offsite portions of the aquifer to below the cleanup goals

proposed by EPA in the Proposed Plan. Consequently, a reasonably reliable estimate of the time required to remove all of the contamination from the offsite portions of the aquifer cannot currently be developed for any of the remedial alternatives.

USEPA Response to Comment #13: The use of six pore volumes was not intended to represent the maximum number of pore volumes required to meet cleanup goals but rather to suggest a minimum number of pore volumes that might be necessary to achieve cleanup. Preliminary evaluation of the flow patterns generated by the flow model suggested that higher pore flushing rates are associated with areas of the aquifer with the highest concentrations and lower flush rates are associated with the areas of the aquifer with lower concentrations. Also, in general, the lower concentrations are in areas of the aquifer in which travel times to reach the extraction well are the highest. These generally coincide with areas at the margins of the plume area, which are furthest from extraction wells. This was one of a number of reasonable simplifying assumptions that were made in order to make estimates of the cleanup time. These assumptions were applied equally to all alternatives. It is USEPA's assessment that the Proposed Plan cleanup time projections, which were based on the minimum number of pore volumes that might be necessary to achieve cleanup, are reasonable for comparison of alternatives.

14. It should be noted that, as discussed elsewhere in these comments on the Proposed Plan, Aerojet believes that the modeling analysis that was conducted by EPA to estimate the time until "restoration" or "remedial action objectives" are achieved was based on an incorrect use of the Western Groundwater flow model and on incorrect assumptions and methodology, contains a high degree of uncertainty, and is unable to provide time estimates of the level of accuracy and precision assumed by EPA. EPA's discussion in the Proposed Plan appears to infer that through "optimal" placement of the containment wells, significant reduction in the time to achieve groundwater restoration can be achieved. The actual time frame required to achieve complete restoration is more a function of the hydrogeologic conditions of the aquifer, the overall distribution of contamination within the aquifer and the numeric cleanup goals that must be achieved, and less a function of the number of wells installed as part of the remedy. The fact that EPA's modeling indicates that all of the remedial alternatives contained in the Proposed Plan would require extremely long time frames (greater than 100 years) to achieve groundwater cleanup goals is an indication that groundwater restoration is technically impracticable within a reasonable time frame.

USEPA Response to Comment #14: USEPA agrees that there is considerable uncertainty in estimating groundwater cleanup times; however, Aerojet did not provide an estimate of remedy duration in the RI/FS. Aerojet provided the approximate percent of area captured by layer within a 25-year evaluation period, which does not meet USEPA's requirement to estimate the life of the remedy. This left USEPA with the task of preparing estimates of the time required to achieve groundwater cleanup for the remedial alternatives. Aerojet prepared a groundwater flow model for evaluating the remedial alternatives in

the RI/FS. USEPA could have chosen to prepare a new groundwater model or to use the existing model that had already been developed for the site. USEPA chose an approach that would use the existing flow model developed specifically for the site and extended the use of the model beyond the 25 year time frame used by Aerojet in the RI/FS by using the longer time frames already established in the model files by Geotrans. The use of the model, particle tracking and particle capture analysis was fundamentally similar to that performed by Aerojet/Geotrans in the RI/FS except that the model simulations were extended for 100 years or more. Use of the existing model was a cost and time effective approach paralleling and extending the modeling methods already documented in the RI/FS.

Many simplifying assumptions had been made in developing the original groundwater flow model for what is a complex groundwater system. Although this flow model is a very general representation of the groundwater system, it is an appropriate tool for comparing the alternatives and the only tool currently available to predict remedy duration. The model is an acceptable approach for comparing remedial alternatives because the groundwater system remains the same and the only variation is the performance of the extraction system. USEPA did not modify the underlying groundwater flow model developed by Aerojet's consultant. The only modification made by USEPA was to add several extraction wells in evaluating Alternative 4C.

Also see Responses to Comments #1 and #6 on technical impracticability.

15. Furthermore, neither perchlorate nor NDMA is a common contaminant and research is still pending to assess analytical detection methods, remedial alternatives, and toxicity. Analytical methods for the extremely low concentrations that are proposed as cleanup goals, or within the range of cleanup goals, only recently have been developed, or in the case of NDMA have yet to be developed and demonstrated. Consequently, the underlying toxicological information as well as remediation and treatment technologies for the extremely conservative "cleanup goals" or "remedial action objectives" proposed by EPA in the Proposed Plan are just now being developed. Therefore, perceived differences in estimated cleanup times should be considered, but should not be a determining factor if the remedial alternatives are equal in the other evaluation criteria.

<u>USEPA Response to Comment #15</u>: There are numerous labs that can detect perchlorate to the 4 ppb level (low end of USEPA risk range) using USEPA Method 314.0 . In the case of N-Nitrosodimethylamine (NDMA), the reliability of method detection capability below 20 parts per trillion (ppt) to the potential remediation goal of 1.3 ppt is currently open to interpretation. The remedy design will be based on the Remedial Action Objective (RAO) while the enforcement of the RAO will be based on repeatable confirmation sampling detection limits.

Treatment technology exists for both NDMA and perchlorate to achieve RAOs. Also see the Response to Comment #2.

The toxicity of NDMA has been assessed and the preliminary remediation goal (PRG) is based on data contained in the USEPA's Integrated Risk Information System (IRIS) and set at the USEPA's one-in-a-million cancer risk level. In the case of perchlorate, USEPA's Office of Research and Development provided Interim Assessment Guidance for Perchlorate dated June 18, 1999. The guidance provides a reference dose range of 0.0001 to 0.0005 mg/kg-day. Using adult parameters, the dose range is equal to 4 to 18 ppb. USEPA has elected to use the low end of the range (4 ppb) for this site because of the impact to drinking water in a heavily populated area and the fact that there is the potential for serious threat to developmental processes in children. Use of infant parameters would reach the USEPA lower end of the risk range.

16. The cleanup goals for perchlorate and NDMA and the low end of the range for VOCs presented in the Proposed Plan are below the levels necessary to achieve protection of human health and for compliance with ARARs. Further, they are below the currently achievable laboratory detection limits and present numerous other technical impracticability concerns along with significant cost-benefit implications. EPA has proposed cleanup goals for OU-3 that are below drinking water standards and has not adequately considered the technical and economical feasibility of attempting to achieve these goals.

<u>USEPA Response to Comment #16</u>: For N-Nitrosodimethylamine (NDMA), the Remedial Action Objective (RAO) is the November 1, 2000 USEPA Preliminary Remediation Goal (PRG), which is the one-in-a-million cancer risk. For perchlorate, the RAO is the low end of the reference dose range provided by the USEPA's Office of Research and Development's Interim Assessment Guidance for Perchlorate dated June 18, 1999. Thus, because of the impact of perchlorate to drinking water in a heavily populated area and the fact that there is the potential for a serious threat to developmental processes in children. The Volatile Organic Compounds (VOCs) RAOs proposed cleanup goals will be based on Maximum Contaminant Levels (MCLs); however, it is the USEPA's assessment that perchlorate and to some extent NDMA will drive the remedy and that VOCs will be cleaned up to below MCLs. The Feasibility Study for the Western Groundwater Operable Unit (WGOU) did not provide a Technical and Economic Feasibility Analysis for the Remedial Action Objectives (RAOs). On June 13, 2000, the Water Board provided the USEPA with a Derivation of Cleanup Values for WGOU, and a copy of this document was provided to Aerojet. The USEPA's National Remedy Review Board presentation package, which was provided to Aerojet July 24, 2000, contained the RAO rationale and the June 13, 2000 Water Board's derivation of cleanup values.

There are numerous labs that can detect Perchlorate to the 4 ppb level (low end of USEPA risk range) using USEPA Method 314.0. In the case of N-

Nitrosodimethylamine (NDMA), the reliability of method detection capability below 20 ppt to the potential remediation goal of 1.3 ppt is currently open to interpretation. The remedy design will be based on The Remedial Action Objective (RAO) while the enforcement of the RAO will be based on available repeatable confirmation sampling detection limits. In the case of VOCs, MCL detection levels are readily achievable from commercial laboratories.

17. EPA has not acknowledged that the remedial alternatives presented in the FS are designed to contain CoPCs since the ability to restore the aquifer has not been demonstrated. EPA has not considered potential economic or social impacts to the region caused by discharging billions of gallons of treated groundwater that already meet drinking water standards into the American River, thereby reducing beneficial uses of the groundwater. Furthermore, EPA has not applied cleanup goals below drinking water standards at any of the reviewed NPL sites in Region IX where RODs or IRODs have been implemented (as presented at the end of this discussion).

<u>USEPA Response to Comment #17</u>: The Feasibility Study (FS) states that the remedial alternatives were developed and evaluated for "addressing contaminants of concern (COCs) in groundwater in the Study Area" (Executive Summary Section ES-1, Paragraph 1, last sentence). The FS does not state that the alternatives are designed to only contain COCs.

Once remediated groundwater will be available for local use. Groundwater discharged to the American River, Folsom South Canal or Lake Natoma can still be used by the local community.

All cleanup goals are site specific. The Aerojet Rancho Cordova site happens to have multiple contaminants other than Volatile Organic Compounds (VOCs) which will drive the cleanup effort. See Response to Comment #16.

18. EPA's National Remedy Review Board (NRRB) [NRRB, 2000] commented on the conservative nature of the proposed cleanup goals because they are inconsistent with national EPA policy and have not been consistently applied by EPA Region IX or the State of California. EPA Region IX has responded to the NRRB's concern by assuming that all the cleanup goals below drinking water standards for all CoPCs will be achieved during the period estimated to achieve the proposed cleanup goal for perchlorate. Aerojet's analyses conclude that this assumption is incorrect and that all cleanup goals below drinking water standards should be re-evaluated in accordance with NRRB direction. In fact, our analysis shows that for the northern portion of the off-site plumes, both NDMA and TCE take significantly longer to meet the proposed cleanup goals than perchlorate.

<u>USEPA Response to Comment #18</u>: The USEPA's National Remedy Review Board requested Region Nine to document in the Record of Decision (ROD) the site specific justification for the cleanup levels; Region Nine agreed to do this. The Response to Comment #16 provides the rationale for USEPA's selection of

the cleanup level for perchlorate and N-Nitrosodimethylamine (NDMA). It is USEPA's assessment that perchlorate in general and NDMA to some extent in the northern portion of the off-property plume will drive the cleanup.

19. EPA has proposed cleanup goals for all CoPCs regardless of whether they are present onsite, offsite, or both. The FS did not evaluate the potential to reach cleanup goals onsite because the sources of these chemicals still exist and will be addressed by a future FS. The cleanup goals presented by EPA should only consider CoPCs detected offsite which include trichloroethane (TCE), perchlorate, N-nitrosodimethylamine (NDMA), 1,2-dichloroethene (1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethene (1,2-DCA), and vinyl chloride. Nitrate and nitrite have been detected offsite, but have not been differentiated from background concentrations and are probably not site-related. Similarly, some of the offsite detections of TCE and PCE, and all of their potentially related breakdown products (1,2-DCE, 1,1-DCE, and vinyl chloride) are from offsite sources other than Aerojet (Aerojet, 2000a).

USEPA Response to Comment #19: The Remedial Action Objectives will be applied to the area between the off-property extraction wells, at the maximum extent of contamination, and the on-property extraction wells. Thus, there is a portion of the Aerojet property that is covered by the Western Groundwater Operable Unit. Of the fifteen Contaminants of Concern (COCs), ten were detected off-property and 15 on-property. The five on-property contaminants not detected off-property are Volatile Organics (VOCs) which will be part of the standard VOC analytical suite. Another reason to test for the 15 COCs is to insure that the on-property extraction system is effectively containing on-property contamination. The purpose of the cleanup goals for on-site COCs is to set the levels that contaminants must not exceed in groundwater migrating off-site. These cleanup goals are both necessary and appropriate.

Because the area off-property with breakdown products of TCE also contains perchlorate, which was used in the past by Aerojet to delineate TCE contamination caused by Aerojet, USEPA does not accept the assertion this contamination is wholly from sources other than Aerojet. In 1962, the water table in the vicinity of Aerojet was approximately 82.3 feet above Mean Sea Level (MSL). The top of the screen of well 30065 is at approximately 67 feet above MSL. Long term water levels indicate that the regional water table fell by 10 to 15 feet a decade; this suggests that the water table in the vicinity of Aerojet was approximately 92 feet above MSL in the early 1950's. It is possible that TCE contamination migrated from the Aerojet site in the 1950's and 1960's to the vicinity of well 30065.

20. Aerojet's specific comments and analyses with respect to EPA's proposed "cleanup goals," "cleanup levels," or "remedial action objectives" (numerical values listed in Table 1 of the Proposed Plan) are organized as follows:

EPA's proposed cleanup goals are inconsistent with regulatory requirements and guidelines in the NCP;

USEPA Response to Comment #20: The NCP requires that the more stringent of state standards and federal standards be applicable to each site. The proposed cleanup goals are consistent with the requirements of the USEPA risk range and the water quality objectives of the Water Board's Central Valley Basin Plan.

21. The technical or economic impacts, consistent with the policies and guidelines of both the NCP and the State, associated with establishing cleanup goals below drinking water standards have not been considered; and

USEPA Response to Comment #21: Aerojet did not include the technical and economic impacts in the Feasibility Study (FS) for perchlorate or N-Nitrosodimethylamine (NDMA), the chemicals which will drive the cleanup, even though Aerojet was advised in the draft comments on the FS that one-in-a-million cancer risk values should be considered in the remediation goals. The biological treatment system for perchlorate developed by Aerojet destroys perchlorate to less than 4 ppb, the present method detection limit and is not concentration sensitive. In the case of NDMA, Ultraviolet (U/V) Oxidation can achieve the NDMA cleanup level. The present Department of Health Services action level for NDMA has only been temporarily raised to the present level.

22. The proposed cleanup goals are inconsistent with cleanup goals at other sites.

USEPA Response to Comment #22: Cleanup levels are site specific. In establishing the cleanup levels for this operable unit (OU), the USEPA evaluated the risk from the fifteen Contaminants of Concern (COC) in the OU along with Applicable or Relevant and Appropriate Requirements (ARARs) which include the water quality objectives of the California Water Board Central Valley Region's Basin Plan. At this site, USEPA determined that perchlorate and, to some extent, N-Nitrosodimethylamine will drive the cleanup. See also Response to Comment #16.

23. Although chemical-specific ARARs based on drinking water use were available for most of the chemicals of concern (see Table C-10 of Appendix C to the RI/FS), EPA has apparently chosen to use TBCs as the basis for cleanup goals because the TBC values were lower than the ARAR values. Maximum Contaminant Levels (MCLs) exist for several of the volatile organic compounds; however, the Proposed Plan presents non-enforceable guidance values as the basis for cleanup goals for many of the VOCs.

USEPA Response to Comment #23: The water quality objectives in the Water Board Central Valley Region's Basin Plan are Applicable or Relevant and Appropriate Requirements (ARARs), not TBCs, and are an appropriate basis for establishing cleanup goals. The Volatile Organic Compounds' (VOCs) Remedial

Action Objectives (RAOs) are being set at Maximum Contaminant Levels (MCLs) for this operable unit (OU); however, it is USEPA's assessment that perchlorate and to some extent N-Nitrosodimethylamine (NDMA) will drive the remedy and that the California Regional Water Quality Board Central Valley Region's, Basin Plan objectives for VOCs will be met.

24. Although the Proposed Plan does not explain the source of the range of individual values presented on Table 1, it appears that they are California Public Health Goals (PHGs), Suggested No Adverse Response Levels (SNARLs), or Integrated Risk Information System (IRIS) values for TCE, PCE, 1,1-DCE, 1,2-DCA.

In the case of several of the VOCs, the basis for the range of goals presented on Table 1 of the Proposed Plan could not be identified. Specifically, the lower values presented for 1,1-DCA and chloroform do not appear to correspond with any known standards or guidance levels or with the one-in-a-million cancer risk-based concentrations or the risk-based concentrations for a hazard index of one as presented in the Feasibility Study. Furthermore, EPA presents values for 1,2-DCE; however, promulgated standards and toxicological information for this compound are based on the specific isomer (cis- or trans-) and not on the compound class as a whole. Even after reviewing the standards and toxicological data for the individual isomers, we were unable to discern the basis for the lower level presented in the Proposed Plan for 1,2-DCE.

<u>USEPA Response to Comment #24</u>: See Response to Comment #23.

25. Similar situations exist for perchlorate and NDMA. MCLs or other promulgated standards have not been established for either of these compounds. The State of California has developed action levels to address occurrences of these compounds in drinking water. A Provisional Action Level (PAL) of 18 parts per billion (ppb) was established by the California Department of Health Services (CA DHS) in 1997 for perchlorate based on a provisional oral reference dose established by USEPA for noncarcinogenic effects. EPA has subsequently revised the RfD upward resulting in a drinking water level equivalent to 32 ppb. An AL of 0.002 ppt was established in 1998 for NDMA which corresponds to a theoretical 10^{-6} cancer risk; however, this level is below the detection limits of most laboratories. Because of the potential for production of NDMA in drinking water treatment processes, as well as laboratory limitations to detect low concentrations of NDMA, DHS subsequently established a temporary action level (TAL) of 0.02 ppt for NDMA. The PALs and TALs were identified as potential TBCs for the Western Groundwater OU in the RI/FS report.

<u>USEPA Response to Comment #25</u>: The action levels developed for perchlorate and N-Nitrosodimethylamine (NDMA) are consistent with the USEPA's risk range and Applicable or Relevant and Appropriate Requirements (ARARs), including the water quality objectives in the State Water Board Central Valley Region's Basin Plan. The Remedial Action Objective (RAO) for NDMA is the November 1, 2000 USEPA Preliminary Remediation Goal (PRG), which is the one-in-a- million cancer risk. For perchlorate, the RAO is the low end of the

reference dose range provided by the USEPA's Office of Research and Development's Interim Assessment Guidance for Perchlorate dated June 18, 1999. The low end of the range is used because of perchlorate's impact to drinking water in a heavily populated area and the fact that there is the potential for a serious threat to developmental processes in children. In addition, the existing perchlorate biological treatment system in operation at the Groundwater Extraction and Treatment E/F Facility which will become part of this operable unit, is not concentration sensitive and destroys perchlorate to less than 4 ppb, which is the present method detection limit.

26. Although California has developed ALs for perchlorate and NDMA in drinking water, EPA has chosen to select substantially lower values. In the case of perchlorate, EPA has proposed a value of 4 ppb, which presumably is based on risk-based calculations using generic exposure factors rather than the site-specific risk-based calculations developed in the RI/FS for the Western Groundwater OU. In the case of NDMA, EPA has proposed a value of 0.0013 ppt which apparently is based on EPA Region IX's Preliminary Remediation Goals (PRGs) [USEPA Region IX, 2000b]. Region IX PRGs incorporate reference doses with standard exposure factors to provide estimates of contaminant concentrations in environmental media that are conservatively considered to be protective of humans over a lifetime. PRGs are intended for use in screening pollutants in environmental media, triggering further investigation and providing an initial cleanup goal if applicable. EPA Region IX has also established a PRG for perchlorate of 18 ppb (the same value as the California AL); however, EPA chose not to use the Region IX PRG as the basis for the perchlorate cleanup goal presented in the Proposed Plan.

USEPA Response to Comment #26: See Response to Comments #16 and #25.

27. EPA has developed guidance on procedures to be used to identify, evaluate and select ARARs and TBCs for Superfund sites (EPA, 1988). This guidance states *"Chemical-specific TBC values such as health advisories and reference doses will be used in the absence of ARARs or where ARARs are not sufficiently protective to develop cleanup goals."* This same guidance also states *"If no potential ARARs are identified covering a particular situation, or if potential ARARs are determined not to be protective, any pertinent criteria, advisories, guidance or proposed standards should be used, and the reasons for their use should be fully documented."* As MCLs have been promulgated for drinking water use and are considered to be protective for public drinking water supplies, there is no justification for selection of values other than MCLs as cleanup goals for groundwater. Furthermore, EPA has not provided any explanation of the basis for many of the values identified in the Proposed Plan or reasons for use of cleanup goals other than MCLs.

USEPA Response to Comment # 27: See Responses to Comments #16 and #25.

28. The EPA has not evaluated the technical or economic impacts associated with establishing cleanup goals below drinking water standards. As discussed elsewhere in

these comments, it may be inappropriate to establish cleanup goals if there is no realistic expectation that those goals can be reached in a reasonable time frame.

USEPA Response to Comment #28: It is USEPA's assessment that the vast majority of the cleanup will be driven by perchlorate. The extent of perchlorate contamination at 4 ppb or 40 ppb within the operable unit are so close that it is USEPA's estimation that over the first 30 years and possibly the first 100 years of the remedy, there is no cost difference in the cleanup at 4 or 40 ppb. Due to the many variables, it may take at least five years to evaluate containment and 15 years or longer to determine the aquifer response to the remedy and evaluate its effectiveness. Because ongoing perchlorate toxicity research is presently reviewing the potential for serious threat to developmental processes in children, it is appropriate to use the low end of USEPA's risk range for the cleanup level. Should new toxicity data or aquifer field data justify a modification of the cleanup levels, the Record of Decision can be amended. See also Responses to Comments #1, #6 and #21.

29. However, if cleanup goals must be established for OU-3, Federal and State guidance allow consideration of technical practicability and economic reasonableness. The cleanup goals proposed by EPA do not meet these criteria for the following reasons:

The proposed cleanup goals will increase the estimated cleanup times by over 50 percent compared to the time required to achieve drinking water standards. The proposed cleanup goals will also add in excess of over $500 million to the total cost of the remedy.

USEPA Response to Comment #29: See Response to Comment #28. Even using the Aerojet's Retardation Factor of 1 for perchlorate and assuming a cleanup level of 18 ppb for the Remedial Action Objective, according to Aerojet the time for cleanup of Layer C at 4 ppb is only 24% greater than their projection, not 50%. However, the more crucial point is that over the first 30 years of the remedy USEPA estimates that the cost of the remedy will be approximately the same at a cleanup level of 4 or 40 ppb. Also see the Responses to Comments #28 and #34.

30. The proposed cleanup goals for NDMA, and the low end of the range for three VOCs (1,1-DCE, 1,2-DCA, and vinyl chloride) are below reliable analytical detection limits.

USEPA Response to Comment #30: Enforcement will be at the available practical quantitation limits that can be duplicated for the Contaminants of Concern.

31. The cost differential between treating NDMA to drinking water standards versus the EPA proposed cleanup goal is approximately $1,800,000 in capital and $140,000 in annual O&M costs. There may be additional cost impacts if the treatment system destruction efficiency is less than predicted at low concentrations.

USEPA Response to Comment #31: DHS has temporarily raised its health based advisory level for N-Nitrosodimethylamine from 2 ppt to 20 ppt. The USEPA believes cost can be reduced by selectively treating only the NDMA contaminated portion of the plume.

32. The needless extraction, treatment, and disposal of billions of gallons of groundwater that already meets drinking water standards is inconsistent with State policies regarding the beneficial use of water.

USEPA Response to Comment #32: Extraction, treatment and disposal of water necessary to restore groundwater to beneficial use is consistent with the requirements of State Water Board Central Valley Region's Basin Plan. Groundwater, once remediated, remains available for local use. The groundwater discharged to the American River, Folsom South Canal or Lake Natoma will be available to the local community.

33. Of the 12 similar NPL sites reviewed for this evaluation in California, neither EPA Region IX nor the State has applied cleanup goals below drinking water standards at any of them.

USEPA Response to Comment #33: See Response to Comment #22.

34. For this analysis, cleanup time estimates have been prepared for TCE, NDMA, and perchlorate to compare the differences in cleanup times between these CoPCs, and to compare estimated cleanup times for the cleanup goals presented in the Proposed Plan and drinking water standards. These estimates were prepared following methodology outlined by EPA and using the estimated pore flush removal times and batch flushing model presented to Aerojet by EPA (USEPA, 2000). The retardation factors were adjusted from those used by EPA in accordance with Geotrans' analysis of EPA's use of the model. This analysis differs from the EPA-prepared estimates in that it considers the different CoPC concentrations present in each layer and the different geographic distribution of CoPCs in the off-site plumes.

USEPA Response to Comment #34: USEPA does not necessarily agree with the retardation factors for TCE and perchlorate used in Aerojet 's analysis (see Response to Comment #139). Enforcement for VOCs will be at the Maximum Contaminant Level. It is USEPA's assessment that perchlorate will control the time to complete the remedy.

35. Aerojet has used EPA's estimated time to remove one pore flush from Layer C of 48 years. Initial CoPC concentrations were assumed to be equal to ½ of the highest iso-concentration contour for TCE (25 μg/L), perchlorate (2,000 μg/L), and NDMA (0.05 μg/L) in Layer C. Layer C was selected to compare the cleanup goals because the longest cleanup times are projected to occur in Layer C. Although Alternative 4B was selected for this comparison, the relative differences in cleanup times are approximately the same for each of the alternatives.

USEPA Response to Comment #35: It is unclear to the USEPA why maximum concentrations were not selected by Aerojet. Maximum concentrations represent the most conservative scenario. Also, the relative differences in cleanup times are greater for Alternative 4B than they are for 4C.

36. Table 1 presents two methods used to evaluate potential cleanup time estimates. The first method evaluated cleanup times based on the maximum levels of CoPCs detected offsite without regard to CoPC and concentration distribution. The second method considers the effects on estimated cleanup times caused by different CoPC distributions and concentrations in the northern and southern portions of the off-site plumes. The northern off-site portion of the plume contains TCE, NDMA, and perchlorate, while the southern portion of the plume is comprised almost exclusively of perchlorate. However, the perchlorate concentrations are very different in each area with average perchlorate concentrations of 400 and 4,000 μg/L in the northern and southern areas, respectively. Each method evaluated estimated cleanup times based on cleanup goals presented in EPA's Proposed Plan and applicable drinking water standards.

USEPA Response to Comment #36: See Responses to Comments #34 and #35.

37. The analysis of cleanup times prepared by Aerojet indicates that different CoPCs drive the time required to achieve cleanup goals depending on which cleanup goals are selected. The analysis also shows that achieving the cleanup goals presented in the Proposed Plan are estimated to require in excess of 100 years longer than the time to achieve drinking water standards.

USEPA Response to Comment #37: There are no USEPA Maximum Contaminant Levels (MCLs) for perchlorate or N-Nitrosodimethylamine (NDMA). State drinking water standards for perchlorate and NDMA are based on health advisory levels because there are no MCLs. Also see Responses to Comments #28 and #31.

38. Table 1 shows that TCE takes the longest estimated time (347 years) to reach the cleanup goals presented in the proposed plan using both estimating methods. However, if cleanup goals are established at drinking water standards, then the longest cleanup times are associated with perchlorate in the south (226 years) and TCE in the north (162 years). This analysis also shows that perchlorate cleanup goals will be reached up to 100 years earlier in the northern portions of the off-site plumes than in the southern portions.

USEPA Response to Comment #38: The Volatile Organic Compounds (VOCs) Remedial Action Objective proposed cleanup goals will be based on Maximum Contaminant Levels (MCLs); however, it is the USEPA's assessment that perchlorate and to some extent NDMA will drive the remedy and that the VOCs will be cleaned up to below MCLs.

39. The estimated cleanup times indicate that NDMA cleanup goals will be met within the time frame required to meet cleanup goals for both TCE and perchlorate. However, the analysis presented in the following sections documents other technical and economic considerations with respect to treating NDMA to the cleanup goal presented for NDMA in the Proposed Plan.

USEPA Response to Comment #39: Comment noted.

40. Table 1 also shows significant differences in estimated cleanup times between the low and high end of the range of cleanup goals for VOCs, and between the Proposed Plan cleanup goals and drinking water standards for perchlorate and NDMA. Estimated times to reach drinking water standard cleanup goals range from 53 to 226 years for both methods. Estimated times to reach the proposed plan cleanup goals range from 188 to 347 years. The difference between the longest estimated time to achieve drinking water standards (226 years) and the longest time to achieve the Proposed Plan cleanup goals (347 years) represents the difference in cleanup time between these goals. This difference is approximately 120 years.

USEPA Response to Comment #40: See Responses to Comments #28, #34 and #35. Also, the difference in cleanup times is less for Alternative 4C, because the time to remove one pore volume is 18 years less.

41. Furthermore, there are significant economic impacts associated with operating the offsite containment system for an additional 120 years to achieve EPA's proposed cleanup goals long after all drinking water standards have been reached. The average annual offsite operations and maintenance (O&M) costs for Alternatives 4B and 4C2 are approximately $4 million. In addition, EPA has included 40-year recurring capital equipment replacement costs ranging from $15 to $23 million. If the offsite containment system operates for an additional 120 years to reach EPA's proposed cleanup goals, the estimated costs associated with this period are:

120 years x $4 million/year = $480 million
120 years/40 years x $15 million = $45 million
Total:$525 million

USEPA Response to Comment #41: See Response to Comment #28.

42. It is not economically feasible or reasonable to spend in excess of $500 million dollars extracting, treating, and discharging groundwater that already meets all drinking water standards.

USEPA Response to Comment #42: See Responses to Comments #6, #11, #16, #21 and #22.

43. Several commercial analytical laboratories were contacted regarding their ability to reliably detect the constituents at the cleanup goals proposed by EPA. These laboratories

indicated that they cannot detect the cleanup goals proposed for 1,1-DCE (0.06 μg/L), 1,2-DCA (0.4 μg/L), and vinyl chloride (0.05 μg/L). They also expressed concerns about "false positives" at these low levels. Only one laboratory claims to be capable of detecting NDMA at EPA's proposed cleanup goal (0.0013 μg/L), although performance testing of its capabilities could not independently verify this claim (Aerojet, Exhibit IV-3 NDMA Analytical Methods Evaluation Report [AMER], 1 December 2000).

USEPA Response to Comment #43: USEPA will enforce at practical quantitation limits that are repeatable for contaminants of concern.

44. The containment system envisioned by Alternatives 4B and 4C2 places extraction wells at the maximum extent of Perchlorate as defined by the 4 μg/L contour. It is not possible to determine whether NDMA is present at concentrations below the current method detection limit (MDL) of 0.0075 μg/L beyond the 4 μg/L contour for Perchlorate. If NDMA or any of the VOCs that cannot be detected are present beyond the mapped extent of Perchlorate, there could be significant economic impacts associated with attempting to contain these CoPCs. Obviously, it cannot be assured that the treatment technologies will achieve EPA's proposed cleanup goals for those CoPCs with cleanup goals below analytical detection limits.

USEPA Response to Comment #44: See Response to Comment #16.

45. There are clear economic differences between treating NDMA to EPA's proposed cleanup goal versus treating to the drinking water standard. For the low watt UV NDMA removal technology costed in the FS, for each order of magnitude reduction in NDMA required, one NDMA treatment process unit operated in series is required. Therefore, two additional treatment units are required to be added in series to reduce NDMA concentrations from the DHS TAL of 0.02 to EPA's proposed cleanup goal of 0.0013 μg/L. For example, for the flowrates projected for Alternative 4B, the capital and annual O&M costs associated with two additional UV treatment units to reduce NDMA concentrations to 0.0013 μg/L are estimated to be $1,800,000 and $140,000 per year, respectively. In addition, the O&M costs for NDMA treatment are very sensitive to the price of electricity, and the recent surges in electrical prices and shortages of electricity in California may affect the cost and implementability of NDMA treatment.

USEPA Response to Comment #45: See Responses to Comments #16 and #31.

46. There may be other significant economic impacts associated with achieving the low NDMA cleanup goal. There is uncertainty regarding the efficiency of the UV-oxidation technology when reducing NDMA concentrations to the parts per trillion (ppt) levels. Data collected by more than one UV vendor suggest that the NDMA destruction efficiency may not be as great as predicted in the very low ppt range. Because these concentrations cannot be reliably measured in the laboratory, it is not possible to conduct the testing necessary to evaluate this potential.

<u>USEPA Response to Comment #46:</u> See Responses to Comments #16 and #45.

47. As demonstrated above, using EPA's methodology, the offsite containment system will have to operate for an estimated 120 years after all CoPC drinking water standards have been achieved. This means that groundwater that could be used for its highest designated beneficial use (i.e., drinking water) will be unnecessarily extracted, treated, and discharged to the American River. Depending on the alternative selected, the offsite extraction systems will operate at approximately 3,000 to 4,000 gallons per minute (gpm). Pumping at the lower rate of 3,000 gpm, this results in over 190 billion gallons of water that will be needlessly removed from the aquifer, treated, and discharged to the American River. This is inconsistent with EPA and State policies of using water for its highest beneficial use.

<u>USEPA Response to Comment #47</u>: See Response to Comment #17. The treated water will be available for local use.

48. The Proposed Plan identifies treatment of surface water as one of the advantages of indirect reuse. Specifically, under the surface water discharge (indirect reuse) option preferred by EPA, the groundwater treated as part of the proposed remedial action for OU-3 – which otherwise would meet State and federal drinking water standards - would subsequently be diluted by river water and *"…the water would be treated again before any downstream systems distributed it to consumers."* However, the treatment processes that would be employed for surface water do not remove the chemicals of concern in the Western Groundwater OU. Surface water that is to be used for potable water supply is typically subjected to coagulation, settling, filtration and disinfection. None of these processes is intended or expected to treat or remove perchlorate, NDMA or VOCs. Therefore, such treatment is neither part of nor required to be part of the remedy for OU-3. Other options, such as installation of replacement wells or inter-ties with other water providers, are currently being evaluated as mechanisms for provision of alternative water supplies. If one of these mechanisms is selected, there would be no use of surface water for the selected remedy, and the associated surface water treatment would not apply.

<u>USEPA Response to Comment #48</u>: The USEPA has not ruled out the direct discharge of treated groundwater to a drinking water system. However, this will need to be permitted by CADHS.

49. Furthermore, under the scenario proposed by EPA, the OU-3 groundwater would be treated to remove NDMA to a level far below the current State action level, and in fact below the current analytical capabilities of commercial laboratories. This water would then be discharged to surface water where, under the scheme envisioned by EPA, the surface water would be diverted and subjected to additional treatment. Studies conducted by the Metropolitan Water District of Southern California, the California DHS, and others (Proceedings of the American Water Works Association Water Quality Technology Conference, November 5-9, 2000) have indicated that chlorination of surface water, a necessary and required treatment process for surface water, can result in generation of

NDMA in the treated water at levels greater than that proposed by EPA as the cleanup goal for NDMA in groundwater. Consequently, under EPA's indirect reuse option, Aerojet could end up spending tens if not hundreds of millions of dollars removing NDMA to a level well below that found in many food products and water supplies, only to have the surface water treatment processes re-introduce NDMA at levels above the cleanup goal.

USEPA Response to Comment #49: Confirmation sampling of the American River has not shown contamination by N-Nitrosodimethylamine (NDMA). The potential reconstitution of NDMA does not occur with all NDMA treatment processes. The surface water treatment method for NDMA to be used in the new surface water treatment plant for the Western Groundwater Operable Unit will be specifically reviewed to insure reconstitution is not an issue. The present state action level for NDMA has only been temporarily raised to 20 ppt.

50. Aerojet has not estimated the potential economic harm due to the loss of a significant quantity of drinking water. However, water supplies are in very high demand in the region and the potential benefits of supplying groundwater that meets all drinking water standards must be weighed against EPA's desire to achieve cleanup goals that do not improve the beneficial use of the groundwater.

USEPA Response to Comment #50: The treated groundwater is available to the community. The treated groundwater discharged to the American River, Folsom South Canal or Lake Natoma can be used by the local community.

51. The preceding sections have shown that there are clear technical and economic impacts associated with EPA's proposed cleanup goals. In addition, as presented in General Comment 1, it is likely technically impracticable to achieve EPA's proposed cleanup goals. Many of the technical uncertainties identified at OU-3 have been encountered at other NPL Sites in Region IX. Aerojet has reviewed the available RODs and IRODs for 12 NPL sites in Region IX to evaluate how EPA has responded to these uncertainties at other sites.

USEPA Response to Comment #51: Site cleanup levels are site specific and there are very few sites, if any, with the mixture of Aerojet contaminants. See also Responses to Comments #6, #16 and #31.

52. EPA has documented in its guidance documents (USEPA, 1988) and through the RODs and IRODs issued throughout EPA Region IX, that cleanup goals should not be established below drinking water standards. In fact, of the RODs and IRODs reviewed for this analysis, not a single cleanup goal below Federal or State Primary or Secondary drinking water standards was found (Table 2). Although only a limited number of RODs were reviewed during the public comment period allowed for the Proposed Plan, EPA Region IX has indicated that they have not established cleanup goals below MCLs for any NPL sites in Region IX. The only explanation for the extremely low cleanup goals proposed for this OU would be potential State ARARs or TBCs that address anti-

degradation. However, the NCP clearly states that all state ARARs do not have to be met if "*the state has not consistently applied, or demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state"* (40 CFR 300.430(f)(ii)(C)(5)). This is particularly relevant to the Regional Water Quality Control Board (RWQCB) anti-degradation policies that have not been promulgated and should only be considered as TBCs.

USEPA Response to Comment #52: Site cleanup levels are site specific and there are very few sites, if any, with the mixture of Aerojet contaminants. It is the USEPA's assessment that perchlorate will drive the majority of the cleanup. The water quality objectives in the Water Board Basin Plan are Applicable or Relevant and Appropriate Requirements (ARARs). The state's anti-degradation policy has been promulgated and is a potential ARAR if treated groundwater will be reinjected.

53. Since no other RODs or IRODs have been issued with cleanup goals below drinking water standards, it would be inconsistent -- in fact capricious and arbitrary -- for the EPA to apply more stringent goals to OU-3. Most of the sites that were reviewed do not have groundwater plumes that are as extensive and heavily impacted as those in OU-3. Therefore, if the technical and economic reasonableness considerations outlined in the Federal and State guidance were ever to be applied, OU-3 would be the logical place. Furthermore, many of the RODs indicated that the treated groundwater was being directly reused as drinking water. It would be inconsistent for EPA to establish cleanup goals that are more conservative for OU-3, and at the same time eliminate direct reuse of the treated water if the water could be directly served to the public.

USEPA Response to Comment #53: Site cleanup levels are site specific and there are very few sites, if any, with the mixture of Aerojet contaminants. See also Responses to Comments #16 and #31. USEPA has not eliminated direct discharge to the drinking water system; see the Response to Comment #4.

54. The EPA's preference for Alternative 4C2 in the Proposed Plan is predicated on the inappropriate use of the Western Groundwater flow model to calculate cleanup times and incorrect assumptions and estimates regarding an inferred shorter cleanup time for groundwater restoration compared to Alternative 4B. These inappropriate cleanup time estimates were critical in ranking Alternative 4C ahead of Alternative 4B for four of the nine evaluation criteria. Aerojet questions EPA's comparison of Alternatives 4B and 4C using the following four of the nine NCP alternative evaluation criteria:

> Long-term Effectiveness and Permanence;
> Reduction in Toxicity, Mobility and Volume;
> Short-Term Effectiveness; and
> Cost.

With the exception of long-term effectiveness and permanence, EPA ranked Alternative 4C better than Alternative 4B for each of these criteria. For long-term effectiveness and

permanence, EPA ranked Alternative 4C and Alternative 4B equally. The comparative analysis of alternatives presented in the Proposed Plan did not follow the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988) that specify the evaluation factors that should be considered under each of these criteria. The following sections summarize the comparisons of Alternatives 4B and 4C2 following the NCP and EPA guidance. These analyses conclude that Alternative 4B better satisfies these criteria than Alternative 4C2. Detailed analysis supporting the summaries presented below follow those summaries.

USEPA Response to Comment #54: See Responses to Comments #55, #58, #59, and #117.

55. Aerojet raised significant concerns regarding the potential for Alternative 4C to induce the downward migration of CoPCs from Layer C into Layer D which would negate the perceived benefits associated with Alternative 4C. EPA responded to these concerns by modifying Alternative 4C to include additional extraction wells in Layer C (and Layer D and E where Layer E wells were proposed) to mitigate downward CoPC migration (referred to as Alternative 4C2). However, EPA's analysis shows that these mitigation efforts will not eliminate downward CoPC migration. The intent of Alternative 4C2 is defeated if CoPCs are allowed to migrate through the portions of Layer D downgradient of the offsite interior containment system. Furthermore, the installation of an interior line of extraction wells between the downgradient and on-site containment barriers may cause additional problems by increasing the hydraulic gradient between the on-site and offsite interior containment systems. A steeper hydraulic gradient at this location may decrease the effectiveness of the on-site containment system and allow previously contained CoPCs to migrate offsite.

USEPA Response to Comment #55: Aerojet has raised several concerns concerning the potential for wells installed for Alternative 4C to induce downward migration of contaminants from Layer C. This is an important issue that is best addressed during remedial design. USEPA prefers Alternative 4C because it includes a similar system of extraction wells for Layer C as proposed in Alternative 4B but includes extraction from Layers D and E at the earliest possible time. This minimizes the potential for contamination of additional area of Layers D and E. USEPA also recognizes that significant design considerations need to be addressed before implementing the Layer C and D extraction system envisioned in Alternative 4C. These issues should be addressed in the remedial design phase, when it is likely that some paired C and D - layer extraction wells will have to be installed to test the model hypothesis that groundwater will be pulled from the C layer to the D layer. The interior plume wells will be more than 3000 feet from the on-site extraction wells. A very long-term pump test would be required to test this hypothesis; this would be best implemented at the beginning of the remedy since it may take several years to establish a 1500 foot radius of influence around each pumping well. If it is determined during remedial design that early Layer D and E remediation is impractical, the inner extraction wells will not be installed.

56. EPA's analysis presented in a letter to Aerojet dated October 17, 2000 indicates that approximately 7 percent of the CoPC volume in Layer C will migrate downward into Layer D for both Alternatives 4B and 4C2. While Alternative 4B anticipates this migration, and places downgradient extraction wells in Layer D to contain these CoPCs, Alternative 4C2 does not. Therefore, under Alternative 4C2, CoPCs that migrate into Layer D beyond the interior extraction well locations must be contained by a second line of extraction wells in Layer D. This defeats the entire benefit of Alternative 4C2. In addition, evaluation of CoPC iso-concentration maps indicates that portions of the Layer D CoPC plumes are so close to the leading edges of the CoPC plumes in Layer C, that it is not practical to consider different extraction well locations for each layer (hence the design of Alternative 4B).

<u>USEPA Response to Comment #56:</u> It is USEPA's assessment that with well optimization and a good design phase, the concerns regarding the migration of contaminants downward from Layer C will be addressed. It is likely that it will be necessary to install some paired C and D layer extraction wells near the leading edge of the D layer contaminant plume to test the model hypothesis that groundwater will be pulled from the C layer to the D layer. The D layer extraction wells proposed in the Feasibility Study (Figure 4-6) are more than 6000 feet from the current extraction wells and the nearest monitor wells are more than 1000 feet away, so it is likely that the geology may be different. Since the location of these wells will be based on the extent of the contaminated plumes at the time of the design phase, it is not possible to accurately predict hydrogeologic characteristics and well performance at this time.

Containment of contamination that may be flowing from Layer D to Layer C in the vicinity of well 1464 will be captured by Layer D extraction wells D5 and D6; these wells are part of the original conceptual design for Alternative 4C that was included in the Feasibility Study (See Figure 4-6). There is no evidence that groundwater containing perchlorate at higher concentrations is migrating from Layer C to Layer D in any other area in OU-3 off-site.

57. In addition, there are no potential benefits to placing extraction wells in Layer E. TCE is the only CoPC detected in Layer E offsite, and the TCE concentrations are so low (22 μg/L) that it is unlikely that a remedial action would be needed in Layer E. Therefore, Alternative 4C2 does not provide any additional benefit in Layer E than 4B.

<u>USEPA Response to Comment #57:</u> N-Nitrosodimethylamine and perchlorate have also been detected in layer E off-property wells (see Western Groundwater Operable Unit Remedial Investigation/Feasibility Study, Volume II, Figures A34 and 35).

58. The preceding paragraphs question the technical ability of Alternative 4C2 to contain the leading edge of the Layer D plumes, and note that Layer E probably doesn't require containment offsite. In addition, any distinction between these two alternatives based on perceived differences in cleanup times should not be weighed too heavily given the

uncertainties associated with cleanup time assumptions. Therefore, the technical considerations and minor perceived benefits suggest that Alternative 4B is more likely to contain the CoPCs plumes as intended than Alternative 4C2 and should be ranked higher than Alternative 4C2 for long-term effectiveness.

<u>USEPA Response to Comment #58:</u> It is USEPA's assessment that significant benefits can be achieved by extracting groundwater from Layers D and E at locations close to the current extent of the groundwater contaminant plumes in these layers. Both Alternatives 4B and 4C provide for groundwater extraction from Layers D and E. The principal difference between the two Alternatives is primarily a matter of timing and the area or volume of contaminated groundwater that must be remediated in Layer D and E. Immediate extraction from Layer D and E is implemented in Alternative 4C while in Alternative 4B, groundwater extraction from Layers D and E begins 20 to 40 years later, after large additional areas of these aquifers are contaminated. Alternative 4C2 was intended to evaluate a generalized pumping configuration. The actual well configuration selected to meet the objectives of Alternative 4C will be based on the extent of the contaminant plumes and will be determined during remedial design.

59. Aerojet agrees with EPA that Alternatives 4B and 4C equally reduce the toxicity, mobility, and volume of CoPCs. However, Aerojet does not agree with EPA's conclusion that Alternative 4C2 is better than Alternative 4B for this criterion because it removes a portion of the volume faster than Alternative 4B. The NCP and RI/FS guidance (USEPA, 1988) do not discuss or identify any factor related to the overall time for aquifer restoration under the criterion of reduction of toxicity, mobility or volume through treatment. This criterion was included as part of the nine criteria for remedy selection to reflect Congress' and EPA's preference for permanent treatment and destruction of contamination as opposed to offsite land disposal or other types of remedial actions that do not include permanent treatment. Therefore, Alternatives 4B and 4C2 should be ranked equally with respect to the evaluation criteria.

<u>USEPA Response to Comment #59:</u> USEPA does not agree that Alternatives 4B and 4C should be ranked equally. Alternative 4C begins removing contaminant mass in the Layer D and E many years sooner than Alternative B. Also Alternative 4C prevents migration of contaminants in Layers D and E and reduces the future volume of contaminated aquifer that must be remediated. See USEPA guidance document (EPA-R-98-031) Highlight 6-24, page 6-31 which allows for evaluation of the treatment technologies. The intent of the NCP is that groundwater should be returned to beneficial use as quickly as possible.

Alternative 4C also reduces the volume of contamination more effectively than Alternative 4B, because more contamination will be removed by Alternative 4C. See the Response to Comment #69.

60. Aerojet does not agree with EPA's conclusion in Table 3 of the Proposed Plan that Alternative 4B is "second best" and Alternative 4C is "best" with respect to the NCP

primary balancing criteria of Short-Term effectiveness. On page 12 of the Proposed Plan, EPA apparently has based its preference for Alternative 4C on its evaluation that "….Alternative 4C more effectively prevents the spread to the west of contamination in layers D and E and reduces clean-up time. 4C achieves RAOs in 240 years or only 3 percent longer than 4A, but faster than 4B by an estimated 108 years or 31 percent." As discussed under Aerojet's comment regarding the Long-term Effectiveness and Permanence primary balancing criteria, Alternative 4C does not more effectively prevent the spread to the west of contamination in layers D and E. If the factors identified in the NCP to be considered as part of the Short-Term effectiveness criterion are properly evaluated; i.e., *"time until protection is achieved,"* not the time until groundwater restoration, groundwater cleanup, or RAOs are achieved; Short-Term risks to the community; impacts to workers; and potential environmental impacts, Alternative 4B should be ranked "best" under the Short-Term effectiveness criterion.

<u>USEPA Response to Comment #60:</u> USEPA does not agree with the conclusion that Alternative 4B ranks best in terms of Short-Term effectiveness. Alternative 4C is best because of removal contamination in Layers D and E will begin many years sooner than Alternative 4C and the aquifer area between the Alternative 4C Layers D and E wells and the "fence line" wells in Alternative 4B will not be contaminated. It is USEPA's assessment that design considerations for contaminant migration between layers can be adequately addressed in remedial design. USEPA guidance document (EPA-R-98-031) Highlight 6-24, page 6-31 provides for the evaluation of the remedy until cleanup levels are achieved, and the need to "note the time frame to achieve available use" of groundwater (i.e., to achieve cleanup) is specified in the penultimate bullet on pages 6-27.

61. EPA has ranked Alternative 4C2 ahead of Alternative 4B in terms of lower overall costs. This is an incorrect conclusion based on inappropriate cleanup time calculations that were used to calculate lifetime non-discounted remedy costs. EPA's most recent cost guidance (USEPA, 2000) states on page 4-2: "Non-discounted constant dollar costs are presented for comparison purposes only and should not be used in place of present value costs in the Superfund remedy selection process."

While Aerojet agrees that the costing guidance suggests that non-discounted costs should be used for comparison purposes, as discussed elsewhere in these comments, Aerojet does not agree with the "duration" estimates in Table 2 of the Proposed Plan for each alternative. The non-discounted and present worth costs in Table 2 need to be highlighted or notation needs to be made in Table 2 that the non-discounted costs are only to be used for comparison, while the present worth costs are used for remedy selection. Therefore, on a present worth basis, Alternative 4B is a lower cost alternative than Alternative 4C.

<u>USEPA Response to Comment #61:</u> In reference to "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," Aerojet appears to have taken a single sentence out of context. The guidance clearly advocates the use of a "no discounting" cost analysis. The quoted sentence means that one

cannot use the "no discounting" scenario IN PLACE OF the "net present value" scenario when making the remedy selection decision. One is clearly entitled to perform the analysis and present the results in the ROD as part of the comparative analysis of alternatives. The non-discounted cost estimate is relevant information that should be considered. The USEPA guidance EPA 540-R-00-002, page 4-2 states "Past USEPA guidance recommended the general use of a 30-year period of analysis for estimating present value costs of remedial alternatives during the FS (USEPA 1988). While this may be appropriate in some circumstances, and is a commonly made simplifying assumption, the blanket use of a 30-year period of analysis is <u>not</u> recommended. Site-specific justification should be provided for the period of analysis selected, especially when the project duration (i.e., time required for design, construction, O&M, and closeout) exceeds the selected period of analysis.

For long-term projects (e.g., project duration exceeding 30 years), it is recommended that the present value analysis include a "no discounting" scenario. A non-discounted constant dollar cash flow over time demonstrates the impact of a discounted rate on the total present value cost and the relative amounts of future annual expenditures. Non-discounted constant dollar costs are presented for comparison purposes only and should not be used in place of present value costs in the Superfund remedy selection process." Page 4-10 of the guidance also states "As Exhibits 4-4 and 4-6 indicate, discounted values of even large costs incurred far in the future tend to be negligible. For example, for a 200-year project with constant annual costs of $500,000 at 7%, 99.9% of the discounted O&M costs are incurred in the first 100 years, 97% in the first 50 years, and 88% in the first 30 years. The period of present value analysis, however, should not be shortened to less than the project duration (Section 4.1), particularly when O&M costs are significant, or when major costs, such as replacement or corrective maintenance, are expected to occur in the future. In addition, evaluation of a "no discounting" scenario would be recommended pursuant to discussion in Section 4.1."

62. The long-term effectiveness and permanence of Alternatives 4B and 4C2 will be assessed by the respective ability of these alternatives to contain the leading edges of the COCs plumes. Alternative 4C2 was judged by EPA as superior to Alternative 4B because it places an offsite interior line of extraction wells at the "leading edge" of the CoPC plumes in Layers D and E earlier than Alternative 4B. The placement and operation of the off-site extraction wells and hydrogeologic characteristics of the aquifer will determine the long-term effectiveness of the offsite extraction system(s).

The conceptual potential difference in long-term effectiveness between Alternatives 4B and 4C2 may occur if Alternative 4C2 is effective at containing the leading edges of the CoPC plumes in Layers D and E earlier than Alternative 4B. In order to accomplish this objective, the interior offsite extraction wells proposed under Alternative 4C2 must be located at the leading edges of the CoPC plumes in Layers D and E. The contaminant distribution maps prepared for the RI/FS were reviewed to compare the proposed

extraction well locations with the known extent of CoPCs. This comparison was conducted using the RI/FS figures, although because the plumes continue to migrate and the data range from 1 to 3 years old, the actual extent of CoPCs may be different than depicted on these figures. Layers D and E are discussed separately below.

Layer D The furthest extent of CoPCs in Layer D is defined by Perchlorate. Alternative 4C2 places four extraction wells in Layer D (and four consequent Layer C extraction wells) west of Aerojet and east of the downgradient containment system to address the Perchlorate. However, the Perchlorate plume has already passed two of the proposed extraction well locations in Layer D (Figure 1). Therefore, this portion of the plume in Layer D will not be contained by the Alternative 4C extraction wells, and plume containment will require the installation of additional extraction wells in Layer D at the downgradient extraction system (i.e., approximately Zinfandel Drive). The failure to contain the leading edge of Perchlorate in Layer D defeats the entire purpose of Alternative 4C2.

USEPA Response to Comment #62: The well locations in the FS and proposed plan are part of a conceptual design, not the actual design to be implemented. The actual well locations and pumping rates will be determined during the design phase of the remedy implementation. The locations must be optimized based on the most current information, including the extent of the contaminated plumes, available at the time of design.

63. The extraction wells proposed in Layer D are also predicted to pull CoPCs currently present in Layer C down into Layer D. Aerojet and EPA modeling suggest that approximately 7 percent of the CoPCs present in Layer C will migrate downwards into Layer D. Some of these CoPCs will be captured by the Layer D extraction wells and others will migrate westward toward the downgradient containment wells at approximately Zinfandel Drive. This vertical CoPC migration precludes the objective of containing CoPCs in Layer D, and it may also increase the time required to achieve the ultimate objective of aquifer restoration in Layer D because the CoPC concentrations are approximately 10 times higher in Layer C than Layer D.

USEPA Response to Comment #63: This conclusion is premature. The optimization of well locations and specifications that are necessary during the design phase will likely further reduce the percentage of COCs that will migrate from the C layer into the D layer. It is likely that one or more paired C and D layer extraction wells will have to be installed during the design phase to test the model hypothesis that groundwater will be pulled from the C layer to the D layer.

It should also be noted that the proposed extraction wells are located more than 6000 feet from the current extraction wells and more than 1000 feet from the closest monitor wells. The actual geologic and hydro geologic conditions will need to be assessed during the design phase at the extraction well locations selected during design.

64. Furthermore, the interior extraction wells that are proposed for Alternative 4C2 might also reduce the long-term effectiveness of the onsite extraction system. Alternative 4C2 places six extraction well clusters (Layers D and E) closer to the western Aerojet property boundary than Alternative 4B. The placement of the offsite extraction wells relatively close to the onsite containment system will increase the hydraulic gradient across the site boundary. The steeper hydraulic gradient in this area increases the potential that CoPCs may not be contained by the onsite containment system. The onsite containment system is relied upon to prevent a greater variety and higher concentrations of CoPCs present onsite from migrating offsite.

USEPA Response to Comment #64: The alternative C2 wells are 3000 to 6000 feet from the on-site containment system. It is unlikely that wells at this distance will have a significant impact; however, this potential needs to be evaluated and addressed during remedial design. This will likely be done when one or more C and D layer extraction well pairs are installed and tested to evaluate geologic and hydrogeologic performance, although it will likely take more than a short test to impact wells that are 3000 to 6000 feet away. Note that most on-site wells are located less than 1000 feet from other extraction wells.

65. Layer E Alternative 4C places two extraction well clusters to contain the CoPCs in Layer E near the intersection of Sunrise Boulevard and Highway 50. Layer C and D extraction wells will also be required at each of these locations to minimize vertical CoPC migration, so a total of six new extraction wells and related piping, treatment, and discharge will be added to address the CoPCs present in Layer E offsite.

USEPA Response to Comment #65: Because the Layer D extraction wells are beyond the E layer wells, the additional C and D layer extraction wells should not be necessary, and additional costs will not be incurred.

66. Evaluation of the distribution of CoPCs in Layer E is revealing. TCE is the only CoPC detected offsite and was detected in a single well that is screened in Layer E near ACWS Well Number 15 (Figure 2). TCE was not detected in two additional monitor wells also screened in Layer E at the same location. Therefore, one would conclude that TCE is distributed in a very thin zone within Layer E at relatively low concentrations (22 μg/L). The low concentration of TCE in Layer E will likely attenuate to levels below concern before it reaches any water supply wells. If no other actions were being considered offsite, it is highly unlikely that an offsite action would be contemplated for the TCE detected in Layer E. Therefore, the installation of six extraction wells and related piping and treatment to contain the TCE in Layer E is unreasonable and does little to further the objectives of the proposed remedial effort.

USEPA Response to Comment #66: TCE is not the only contaminant present in Layer E. Figures A-35 and A-36 (in Volume II of the RI/FS) show that perchlorate and NDMA were also detected in two or more offsite wells. As previously discussed, cleanup and restoration of Layer E to beneficial use is required by the Water Board Central Valley Region's Basin Plan. However, the

actual number and location of extraction wells will be determined during the design phase, and will be based on the most current data available at that time.

67. This analysis shows that Alternative 4C2 will not accomplish its objective of containing CoPCs at the leading edge of Layer D. In addition, there are significant concerns that the interior line of offsite extraction wells will induce downward CoPC migration from Layer C into Layer D and reduce the effectiveness of the onsite containment system.

USEPA Response to Comment #67: As stated in the Response to Comment #60, the FS presents a conceptual design. The actual location of the D layer wells must be optimized during design, so that COCs will be contained while cleanup is being achieved. The location and specifications of the 4 additional C-layer wells will also be optimized to minimize downward migration of COCs. There is no evidence to support the supposition that the effectiveness of the on-site containment system will be reduced; the current extraction wells on-site are spaced closely, while the interior line of wells is 3000 to 6000 feet from the on-site extraction wells; however this can be assessed during design as discussed in the Response to Comment #64.

68. This analysis also indicates that remedial action may not be required offsite in Layer E, as containment of very low concentrations of TCE requires a substantial amount of offsite infrastructure that is not proportional to any kind of potential benefit in Layer E. A supplemental analysis evaluating the natural attenuation of CoPCs in Layer E offsite is highly recommended before any offsite remedial actions are implemented in Layer E. The technical concerns addressed in this section regarding long-term effectiveness and permanence should be a sufficient basis to eliminate Alternative 4C2 from consideration.

USEPA Response to Comment #68: See Responses to Comments #55 and #57.

69. The NCP lists the factors to be considered under the criterion of reduction of toxicity, mobility or volume through treatment. Specifically, the NCP requires evaluation of the alternatives in terms of the degree to which they employ recycling or treatment that reduces toxicity, mobility or volume including how treatment is used to address the principal threats posed by the site. The specific factors to be considered as part of this evaluation include:

1. The treatment or recycling processes the alternatives employ and materials they will treat;

2. The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated or recycled;

3. The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment or recycling and the specification of which reduction(s) are occurring;

4. The degree to which the treatment is irreversible;

5. The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents; and

6. The degree to which treatment reduces the inherent hazards posed by principal threats at the site.

The detailed evaluations of the various remedial alternatives presented in the Feasibility Study prepared for OU-3 determined that Alternatives 4B and 4C met the criterion of reduction of toxicity, mobility or volume through treatment equally. Both alternatives employ the same treatment process and produce similar residuals although Alternative 4C will produce more biosludge because the flowrate to be treated under Alternative 4C is greater.

As part of their evaluation of the reduction in toxicity, mobility or volume through treatment, EPA states on Page 12 of the Proposed Plan that "Of these, Alternative 4C would install all remedy components the earliest and remediate layers D and E the fastest. 4C would reduce the volume of contaminated groundwater faster than 4B by an estimated 108 years or 31 percent."

Based on the statements in the Proposed Plan, it appears that EPA has determined that in terms of the reduction in toxicity, mobility, or volume through treatment criteria, Alternative 4C is better than Alternative 4B solely because of EPA's determination that Alternative 4C will restore groundwater quality faster. The factors identified in the NCP that are to be considered as part of the evaluation of the reduction of toxicity, mobility or volume through treatment criterion were listed above. The NCP does not discuss or identify any factor related to the overall time for aquifer restoration under the criterion of reduction of toxicity, mobility or volume through treatment. This criterion was included as part of the nine criteria for remedy selection to reflect Congress' and EPA's preference for permanent treatment and destruction of contamination as opposed to offsite land disposal or other types of remedial actions that do not include permanent treatment.

<u>USEPA Response to Comment #69:</u> The preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 8732 states "USEPA's preference is for rapid restoration, when practicable, of Class I ground waters and contaminated groundwater that are currently, or likely in the near-term to be, the source of drinking water supply. The most appropriate time frame must, however, be determined through an analysis of alternatives. The minimum restoration time frame will be determined by hydrogeologic conditions, specific contaminants at a site, and the size of the contaminant plume." Section 300.430(a)(iii)(F) states "USEPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site." The Feasibility Study did not

contain a justification to waive the beneficial use of the aquifer as a drinking water source.

The mobility of the plume in layers D and E is reduced by Alternative 4C whereas 4B allows contamination in these layers to continue until it reaches the extraction wells located at the extent of the perchlorate plume in Layer C. Alternative 4B allows significant additional contamination of Layers D and E which are not now contaminated and where contamination would not be removed below the remediation goals. It will not be possible to remove all of this contamination; some contamination will be unrecoverable from pore spaces and some will be left because the aquifer will only be restored to cleanup goals. Thus, Alternative 4C removes more contamination volume compared to Alternative 4B where a portion of the contaminated volume is allowed to remain in place.

70. As discussed in the FS and as acknowledged by EPA in the Proposed Plan, all of the alternatives under consideration, including both Alternatives 4B and 4C equally reduce the toxicity of the chemicals of concern in the treated groundwater. Similarly, both the FS and the Proposed Plan indicated that Alternatives 4B and 4C both effectively reduce the mobility of groundwater contaminants. Although not stated in the Proposed Plan, it is clear that both Alternative 4B and Alternative 4C will eventually treat the same volume of contaminated groundwater in the aquifer. Therefore, both alternatives should be ranked equally for this criterion.

<u>USEPA Response to Comment #70:</u> See Response to Comment #69.

71. EPA has also indicated that it prefers Alternative 4C because it is supposedly better in terms of Short-Term effectiveness. The NCP lists the factors to be considered as part of the Short-Term effectiveness criterion to be evaluated as part of the analysis of remedial alternatives and selection of a remedy. Specifically, the Short-Term impacts of alternatives shall be assessed considering the following:

    1. Short-Term risks that might be posed to the community during implementation of an alternative;

    2. Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;

    3. Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and

    4. Time until protection is achieved.

    As discussed elsewhere in these comments, due to the greater amount of pipeline construction associated with Alternative 4C and the consequent greater disruption to streets and right-of-ways, Alternative 4C will pose additional Short-Term risks to the

community during the construction phase. Similarly, due to the additional construction required under Alternative 4C, this alternative poses greater risks to workers during the construction phase. Due to the increased amount of water that will be withdrawn from the aquifer under Alternative 4C, this alternative does create the potential for additional environmental impacts through reduction in aquifer water levels and possible resultant impacts to supply wells in the area; however, the effect of these impacts may be offset through provision of alternative water supply to mitigate these impacts.

USEPA Response to Comment #71: Based on USEPA's analysis, the amount of water withdrawn from the aquifers is actually 100 gallons per minute greater for Alternative 4B than it is for Alternative 4C. This analysis includes the wells that USEPA added to control contamination that may bypass the extraction wells in both Alternatives 4B and 4C and the 4 C-layer extraction wells that USEPA added to minimize groundwater flow and contaminant migration from the C layer down to the D layer.

USEPA also believes that proper control and construction procedures will minimize the short term risk to the community during the implementation of either alternative. For example, water can be sprayed to minimize potential exposure to dust, trenches would be covered when work is not occurring in the vicinity of the trenches, etc.

72. Protection of the public has been and will continue to be achieved through the program of closing impacted wells and providing alternative water supplies. Additional protection will be achieved with the implementation of the downgradient (approximately Zinfandel Drive) groundwater extraction/containment system. In the Proposed Plan, EPA has based its preference for Alternative 4C over Alternative 4B in part on their assessment that Alternative 4C better meets the Short-Term effectiveness criteria. Specifically, EPA states on Page 12 of the Proposed Plan as part of the summary of their evaluation of the Short-Term effectiveness criteria "*However, alternative 4C more effectively prevents the spread to the west of contamination in layers D and E and reduces clean-up time. 4C achieves RAOs in 240 years or only 3 percent longer than 4A, but faster than 4B by an estimated 108 years or 31 percent.*"

USEPA Response to Comment #72: The risk to public water supply wells is minimized more effectively in Alternative 4C where extraction wells will be placed near the plume boundaries in Layers D and E than in Alternative B where the D and E layer contaminant plumes are allowed to expand and contaminate areas of the aquifer that are not contaminated at present.

73. It is somewhat unclear which Remedial Action Objectives (RAOs) EPA is referring to in this statement, as the Proposed Plan includes both narrative and numeric RAOs. The narrative RAO that may be addressed by this statement is "*.. (4) restore both on-property and off-property western groundwater to beneficial uses.*" - as listed on page 8 of the Proposed Plan. The numerical RAOs that EPA may be referencing are the proposed cleanup goals for the chemicals of concern in groundwater as listed on Table 1 on page 7

of the Proposed Plan. On Table 7, these numeric values are also identified as RAOs. In either case, the factor identified in the NCP is the *"time until protection is achieved"* not the time until groundwater restoration, cleanup or the other objectives are achieved. In addition, as stated above, that protection has already been achieved by past and continuing replacement of affected water supplies.

USEPA Response to Comment #73: See Response to Comment #69 preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 8732. USEPA guidance document (EPA-R-98-031) Penultimate bullet page 6-27 specifies the need to "note the time change to achieve available use" of groundwater (i.e., until cleanup is achieved) and Highlight 6-24, page 6-31 provides for the evaluation of the remedy until cleanup levels are achieved. USEPA estimate is that Alternative 4B will take 31% longer or 108 years than 4C resulting significantly more impact.

74. In Comment C of Aerojet's 21 August 2000 Comments on EPA Region IX's National Remedy Review Board Presentation for Western Groundwater OU-3, Aerojet indicated that EPA had significantly altered the cost projections from those contained in the OU RI/FS, the flow rates are different than those modeled in the OU RI/FS (specifically the flow rates for Alternative 4C presented to the NRRB are lower than those predicted for Alternative 4C in the RI/FS), and backup for the changes had not been provided. EPA's October 17, 2000 response to Aerojet's comments indicated that it had extended the costs in the OU RI/FS "out to attainment of Remedial Action Objectives"; added six or seven additional wells in the case that contaminants bypass the extraction wells by "looking at the distance between proposed extraction wells"; added additional monitor wells, piping, treatment plant capacity, and O&M costs corresponding to the added extraction wells; added capital costs "to replace the treatment plant every 40 years"; and included capital and O&M costs for the direct or indirect reuse of treated groundwater. EPA provided a CD-ROM that contained summary spreadsheets for Alternatives 4B and 4C. The summary spreadsheets on the CD-ROM included capital and O&M costs in addition to those contained in the summary spreadsheets provided by Aerojet in Appendix E of the OU RI/FS and extended the capital, O&M, and present worth costs for many years beyond the time period presented in the OU RI/FS.

Specific backup for the added capital and O&M costs shown in the summary spreadsheets on the CD-ROM was requested of EPA, but as of the date these comments were prepared has not been received by Aerojet. In lieu of receiving and reviewing the backup data, an attempt was made to develop the capital and O&M cost detail for the EPA additions given the information provided in EPA's October 17, 2000 response to Aerojet's comments and the cost tables on pages 28 and 29 of EPA's August 22, 2000 NRRB Presentation Package.

USEPA Response to Comment #74: This information was provided to Aerojet by email on January 28, 2001 and again in the Freedom of Information Act letter response submittal dated March 01, 2001.

75. It appears that Alternative 4C in the Proposed Plan is actually Alternative 4C2, as discussed in EPA's October 17, 2000 response letter, and contains at least four additional offsite extraction wells and corresponding treatment capacity (approximately 750 gpm) than Alternative 4C described in the NRRB Presentation Package. EPA did not add additional wells to Alternative 4C where extraction wells are proposed in Layer E (2 Layer C and 2 Layer D wells), and presumably has not included the costs for these additional wells and associated treatment capacity in its cost estimates. EPA needs to point out that Alternative 4C in the Proposed Plan is a significant modification of Alternative 4C in the FS and provide Aerojet with detailed basis (equivalent to that requested by EPA during the FS process) and backup for the cost estimates presented in the Proposed Plan. For example, the text on page 10 of the Proposed Plan in the third paragraph under the heading "Evaluated Alternatives" and Figure 3 need to identify the correct number of extraction wells assumed by EPA in developing the costs for Alternative 4C in the Proposed Plan.

USEPA Response to Comment #75: Because there are C and D layer extraction wells west of the E layer extraction wells, it is not necessary to include C and D layer wells near the E-layer wells in Alternative 4C, and no costs were included. Ten extraction wells were added to Alternative 4C, including 4 C layer wells (that pump a total of 750 gpm) near the 4 layer D wells and 5 C layer and 1 D layer well for contaminant bypass, (pumping at 200 gpm each). In Alternative 4B, there are 7 additional wells, 5 C layer and 2 D layer wells (pumping at 200 gpm each) for contaminated bypass.

76. Aerojet does not agree with the added capital costs to "replace the treatment plant every 40 years" of $19,640,000 for Alternative 4B contained in EPA's summary spreadsheet. While Aerojet reserves the right to reevaluate these costs after specific backup for the costs are received from EPA, it is Aerojet's opinion that these costs, if necessary, should be on the order of $13,000,000.

USEPA Response to Comment #76: This figure has been revised to $18,095,000, for a total savings of $31.8M over the 348-year remedy duration of Alternative 4B. The reevaluation of remedy cost also resulted in a $3.4M increase in the present value costs to $96.3M direct discharge to a drinking water system and $98.2M for surface water discharge.

77. Aerojet does not agree with the added capital costs to "replace the treatment plant every 40 years" of $11,400,000 for Alternative 4C contained in EPA's summary spreadsheet. Specifically, there is no basis for including substantially greater equipment replacement costs under Alternative 4B as compared to Alternative 4C because Alternative 4C has a greater number of extraction wells, flow rate and treatment capacity. While Aerojet reserves the right to reevaluate these costs after specific backup for the costs are received from EPA, it is Aerojet's opinion that these costs, if necessary, should be on the order of $16,000,000 for Alternative 4C.

USEPA Response to Comment #77: This figure has been revised to $17,875,000 *for a total additional cost of $36.4M over the 240 year remedy duration for Alternative 4C, after the wells discussed in the Response to Comment #75 are added. Alternative 4B actually has a 100 gallons per minute higher pumping rate than Alternative 4C.*

78. Table 2 of the Proposed Plan includes O&M costs for direct and indirect replacement water that are integrated with the O&M costs for the remedial alternative. As discussed in the General Comments, it is premature to select an alternate water supply at this time. Aerojet is currently discussing replacement water supply contingencies with affected water purveyors that do not necessarily involve the reuse of treated groundwater. Therefore, EPA should not link the selection of a remedy for OU-3 with the selection of a replacement water supply alternative.

USEPA Response to Comment #78: USEPA has not linked selection of a remedy with the selection of a replacement water supply or with selection of surface water discharge or direct discharge to the drinking water system. Also see Response to Comment 4.

79. In Table 2 of the Proposed Plan, EPA has compared the total projected non-discounted dollars associated with each alternative based on a "duration" (i.e., estimated time to restore groundwater based on modeling evaluations performed by EPA's contractor, the accuracy, validity, and inappropriate use of which are discussed elsewhere in these comments) rather than comparing the costs on a time-equivalent present worth basis. It is Aerojet's understanding that EPA has included projected non-discounted dollars for each alternative in Table 2 because EPA's most recent guidance *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002, July 2000)* indicates on page 4-2 that "…the blanket use of a 30-year period of analysis is not recommended …., especially when the project duration … exceeds the selected period of analysis. For long-term projects (e.g., project duration exceeding 30 years), it is recommended that the present value analysis include a no discounting scenario."

USEPA Response to Comment #79: See Response to Comment #61.

80. EPA's most recent guidance further states on page 4-2: "Non-discounted constant dollar costs are presented for comparison purposes only and should not be used in place of present value costs in the Superfund remedy selection process."

USEPA Response to Comment #80: Non-discounted costs are recommended when the remedy duration exceeds 30 years. See Response to Comment #61.

81. While Aerojet agrees that the costing guidance suggests that non-discounted costs should be used for comparison purposes, Aerojet does not agree with the "duration" estimates in Table 2 for each alternative, as discussed elsewhere in these comments. Further, the non-discounted and present worth costs in Table 2 need to be highlighted or notation needs to

be made in Table 2 that the non-discounted costs are only to be used for comparison, while the present worth costs are used for remedy selection.

<u>USEPA Response to Comment #81:</u> See Responses to Comments #61 and #80.

82. Table 3: Comparison of Alternatives, includes a line for "cost" and alternatives are ranked by cost from lowest to highest based on the non-discounted costs from Table 2. Table 3 needs to be modified to include a line for comparison of present worth costs because, according to EPA's latest guidance, remedy selection shall be based on present worth costs. With respect to present worth costs, the alternatives would be ranked differently than currently shown on Table 3. From lowest cost to highest present worth cost, the order of ranking would be Alternative 4B (lowest cost), followed by 4A, 3A, 5A, 5B, 4C, and 3B. The EPA 30-year present worth estimate for Alternative 4C with direct reuse is $108 million, or 16% greater than the EPA estimate for Alternative 4B of $93 million. Further, the NCP [40 CFR Section 300.430(e)(7)(iii)] states that *"Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated."* As discussed elsewhere in these comments, Alternative 4C provides similar effectiveness and implementability as Alternative 4B. However, it is estimated that Alternative 4C will cost 16% more than Alternative 4B using the cost criteria for remedy selection. Therefore, Alternative 4C should be eliminated and Alternative 4B selected as the preferred alternative.

<u>USEPA Response to Comment #82:</u> See Responses to Comments #31, #61, #76 and #77. Alternative 4C is more effective than Alternative 4B, and will protect Layers D and E from further contamination. Since Alternative 4C is more effective, it should not be eliminated. Alternative 4C is 13% more expensive than Alternative 4C. However, the remedy duration costs (non-discounted costs) should also be considered because O&M costs and replacements occur over more than 200 years (see Response to Comment #61). Alternative 4B is clearly much more expensive over the duration of the remedy. A remedy is cost effective if its costs are proportional to the overall effectiveness; overall effectiveness can be evaluated by evaluating long term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short term effectiveness. The relationship of the overall effectiveness of Alternative 4C was determined to be proportional to its costs and therefore, Alternative 4C represents a reasonable value for its cost.

83. Even though the duration of one or more remedies for a site may be projected to extend beyond 30 years, a period of 30 years is typically used for present worth analyses because (1) the present value of capital and O&M costs in years beyond 30 years adds little to the total present worth of a remedy, and (2) it is difficult to estimate costs so far in the future with any degree of confidence. It is Aerojet's opinion that costs beyond 30 years cannot be estimated with any degree of confidence and accuracy. However, even if present worth costs (as required by the latest EPA cost guidance for remedy selection) were

projected for periods of time greater than 30 years, they would reach a point where future costs add very little, if any, to the present value calculations and Alternative 4B would always exhibit the lowest present worth cost.

USEPA Response to Comment #83: See Response to Comment #61 for explanation why 30-year present value costs are not sufficient.

84. The remedy duration time calculations that EPA used to select Alternative 4C over Alternative 4B are based on arbitrary and unsupported assumptions and the uncertainty associated with the calculations precludes their use as a basis for applying non-discounted cost estimates.

USEPA Response to Comment #84: USEPA disagrees with Aerojet's assertion that the USEPA used arbitrary or unsupported assumptions. See Response to Comments #135 through #151.

85. As discussed elsewhere in these comments on EPA's Proposed Plan, the use of the Western Groundwater flow model to calculate cleanup times is inappropriate. Therefore the "durations" presented by EPA in Table 2 cannot be used to project non-discounted costs for the various alternatives presented in the Proposed Plan.

USEPA Response to Comment #85: The use of the model was appropriate. See Response to Comment #14.

86. The Proposed Plan (at page 10) acknowledges two contingent innovative technologies and indicates that if pilot testing is successful one or more of these technologies could augment the proposed remedy. The NCP expects EPA to consider innovative technologies in 40 CFR 300.430(a)(1)(iii)(E): *"EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies."* Using EPA's capital cost estimates from Table 2 in the Proposed Plan, approximately $6 million more (13% more) in up-front capital costs would be spent under Alternative 4C than Alternative 4B. These additional capital costs would not be recoverable if any of the innovative technologies prove successful. Selection of Alternative 4B, as opposed to Alternative 4C, and implementation of the remedy using a phased approach as discussed elsewhere in these comments on the Proposed Plan would allow for implementation of innovative technologies if they prove successful.

USEPA Response to Comment #86: The USEPA disagrees with Aerojet's assessment; innovative technologies could effectively be implemented in Alternative 4C. Alternative 4C is more effective because the D and E layer wells are installed at the plume boundary; this will minimize the expansion of the contaminant plumes into areas of Layers D and E that are not contaminated at present. These wells will primarily pump low contaminant concentration water. The innovative technologies would likely be most effective in treating the higher

contaminant concentrations which are located closer to the Aerojet site boundaries. If this water is cleaned up in-situ, then clean groundwater would be flushed through the rest of the plume, resulting in faster cleanup. The use of one or more innovative technologies would enhance Alternative 4C and result in a large reduction in remedy duration.

Under Alternative 4B, the contaminant plumes in the D and E layers are allowed to spread, resulting in contamination of large additional areas of the aquifer. The innovative technologies would still be most effective on the more contaminated areas of the plume that are closer to the site boundaries, but the clean groundwater would have to travel further to flush the contaminated pore space in the rest of the plume. It would still be necessary to install the D and E layer wells, and pumping would have to continue for a longer period of time to cleanup contaminated groundwater that is distributed over much greater areas. It is unlikely that there will be a savings in capital costs, by the time the full remedy is implemented.

It should also be noted that the innovative technologies will be most effective in Layer C, where the concentrations are greater. There would be little impact on capital costs if these technologies are only implemented in Layer C.

87. EPA has indicated that direct reuse of treated groundwater cannot be implemented as part of any of the alternatives because Aerojet does not have a DHS approved treatment system. This assumption is incorrect for Alternatives 3A and 3B, where the proposed treatment technologies are approved by the DHS. This assumption is premature for the remaining Alternative 4 and 5 series because DHS has already approved two of the treatment technologies and is currently reviewing the acceptability of the final treatment technology proposed for these alternatives. It is reasonably foreseeable that such DHS approval may be obtained by the time the remedial alternative is implemented.

<u>USEPA Response to Comment #87:</u> See Response to Comment #4.

88. The Proposed Plan assumes that the siting, construction, operation, and integration of a new surface water treatment plant into the water purveyors existing distribution systems is readily implementable. This may not be the case depending on the willingness of the water purveyor to accept surface water, and the ability to locate a new surface water treatment plant in an area that addressees the water supply distribution requirements. Furthermore, as indicated in the FS, water supply contingencies are currently being evaluated and negotiated with affected parties, and it is premature to select an alternate water supply at this time.

<u>USEPA Response to Comment #88:</u> See Response to Comment #4.

89. The Proposed Plan states that indirect reuse provides additional protection to the public. This is not true because any treatment system utilized for direct reuse will have adequate controls to ensure water quality. Furthermore, the types of additional treatment normally

associated with use of surface water as a drinking water supply (i.e., coagulation, settling, filtration, and disinfection) provide no additional treatment of the chemicals of concern in the Western Groundwater OU. In addition, surface water is inherently more polluted than groundwater and recent data suggest that NDMA may be formed during the treatment processes (particularly chlorination) for surface waters.

USEPA Response to Comment #89: See Response to comment #49.

90. Each of these assumptions should be reevaluated given the current water supply situation in OU-3. In addition, Aerojet does not agree with the assertion that indirect reuse will cost less than direct reuse. The following sections present the most recent information regarding the state of DHS approval for the proposed treatment technologies, and address the implementation and costs associated with indirect reuse.

USEPA Response to Comment #90: The costs for direct discharge to the drinking water system and surface water discharge were provided in the Feasibility Study provided by Aerojet. USEPA merely extended the tables to cover the duration of the remedies. The resulting cost comparison came directly from the tables.

91. Obtaining approval for direct reuse of treated water from DHS is a two-step process. The first step is to obtain DHS-approval for the use of the individual treatment technologies in drinking water systems. The second step is to complete the analysis required in DHS's Policy Memo 97-005 that outlines the conditions under which direct reuse may be permitted at a particular site.

The first step towards obtaining DHS approval for the treatment technologies is complete for three of the four treatment technologies proposed for OU-3. The treatment technologies proposed for VOC removal (air-stripping or granular activated carbon) are already approved by the DHS. The DHS has also approved Calgon's ISEP ion exchange perchlorate removal process, and has recently approved the Aerojet-developed, low-watt ultraviolet (UV) NDMA removal technology for use in drinking water systems. Therefore, each of the treatment technologies proposed for Alternatives 3A and 3B are approved by DHS. Aerojet's biological reduction system proposed for perchlorate removal for the Alternative 4 and 5 Series is the only treatment technology that is still undergoing evaluation. This treatment technology is currently being demonstrated for DHS at Aerojet, and DHS approval for this system may be granted as soon as April or May 2001. Therefore, direct reuse should not be eliminated from the Alternatives 4 and 5 series solely because the treatment technologies are not yet approved by DHS.

USEPA Response to Comment #91: USEPA has not eliminated direct discharge to the drinking water system. See Response to Comment #4.

92. The second step towards obtaining DHS approval is to complete the evaluations required in DHS's Policy Memo 97-005 that outlines the conditions under which direct reuse may be permitted at a particular site. These analyses cannot be initiated until the demand for

the treated water is assessed and the treatment system parameters are defined. This process would probably not be initiated for OU-3 until the containment and treatment systems were constructed and operated for some period. However, the DHS has indicated to Aerojet that direct reuse at this Site is not precluded and therefore, should not be eliminated for consideration at the current time (DHS, May 2000).

USEPA Response to Comment #92: See Response to Comments #4 and #91.

93. The siting and construction of a new surface water treatment plant requires that appropriately zoned land be found in an area where the treated surface water can be accepted into the water distribution system. In addition, agreements must be reached with the water purveyors for accepting the treated water and operating the surface water treatment plant. Furthermore, permits or agreements with the United States Bureau of Reclamation may be required if Folsom South Canal, and possibly the American River, is used as a conveyance system.

Indirect reuse also requires that the water purveyor be willing to convert from groundwater to surface water or accept additional surface water into their distribution system. This may not be the case given that there are other water supply alternatives that may be more easily implementable for the water purveyor. For example, it may be more practical to drill a new water supply well or construct an inter-tie with a neighboring water purveyor, than to construct and operate a surface water treatment plant.

USEPA Response to Comment #93: This comment does not consider the limited availability of additional water supplies and the impact of other contaminated sites. There may not be areas where new wells can be drilled. Because of population growth, neighboring water purveyors are unlikely to be able to provide sufficient long-term water supplies.

94. The Proposed Plan states that surface water is safer to use than treated groundwater. However, there are pathological, industrial, and naturally occurring contaminants present in surface water that may not be present in groundwater. In addition, recent data suggest that NDMA may be formed during the chlorination of surface water at concentrations above the proposed cleanup goals (MWD, 2000). If this occurs, there could be more exposure to NDMA from treated surface water than from the direct reuse of treated groundwater.

USEPA Response to Comment #94: See Response to Comment #49.

95. EPA is also assuming that the public may be exposed to unacceptable concentrations of CoPCs from the treatment processes if direct reuse were allowed, presumably from process upsets. This is highly unlikely as the processes employed for ensuring that the treated groundwater meets all drinking water standards are probably substantially more robust than those currently employed at surface water treatment plants.

<u>USEPA Response to Comment #95:</u> As stated in Response to Comment #4 the USEPA is not opposed to direct discharge to the drinking water system. Surface water discharge, however, by its nature reduces the amount of Aerojet treated water received by the water purveyor. The amount of reserve capacity for the Aerojet treatment for upset is not presently known.

96. The EPA has estimated that the total non-discounted costs for indirect reuse are higher than for direct reuse. This conclusion is based on capital and O&M estimates prepared by Aerojet for the FS. These estimates assumed that granular activated carbon (GAC) would be used as a polishing step prior to direct reuse. The annual costs assumed for carbon replacement in the FS were very high, and they are the reason that direct reuse appears to cost more than indirect reuse over time. If the assumptions regarding the frequency of carbon replacement or necessity were changed, direct reuse would be the cheaper alternative for replacement water.

<u>USEPA Response to Comment #96:</u> These assumptions regarding frequency of granular activated carbon (GAC) replacement were made by Aerojet in the Feasibility Study and were presumably based on the best information available to Aerojet technical staff and consultants. If these assumptions are to be changed, Aerojet must provide USEPA and the state agencies with technical justification.

97. The experience gained by EPA and the regulated community over the past two decades with respect to the evaluation and implementation of groundwater remedies at Superfund sites has shown that restoration to drinking water quality (or more stringent levels where required) may not always be achievable due to limitations of available remediation technologies (EPA 1993, 1992, and 1989). In recognition of the technical limitations of existing technologies, EPA has developed specific guidance and criteria for evaluating the potential for technical impracticability of ground-water restoration. EPA has also developed extensive guidance on how groundwater containment, groundwater restoration, or mixed objective groundwater strategies using pump and treat technology should be implemented.

<u>USEPA Response to Comment #97:</u> Aerojet did not present a technical impracticability evaluation in the Feasibility Study. See Responses to Comments #1, #6 and #8.

98. The clear message contained in all of the various and extensive technical guidance that has been prepared by EPA is that groundwater remedies should be implemented using a phased approach. The criteria supporting use of a phased approach presented in these guidance documents are directly applicable to the conditions found at the Western Groundwater OU and therefore EPA should select a remedy for the Western Groundwater OU that is based on a phased approach towards implementation and achievement of the remedial action objectives.

<u>USEPA Response to Comment #98:</u> Given the size of the contaminant plumes at the time the Feasibility Study was written (approximately nine square miles in Layer C. approximately 4.6 square miles in Layer D and about 1 square mile in Layer E), and the complexity of the hydrogeology, it is economically imperative that the remedies prevent the further spread of contamination of the aquifer Layers C, D and E. Preventing the further spread of contamination is also an imperative to protect the beneficial use of uncontaminated portions of the aquifer. Implementing the OU-3 remedy in stages with an evaluation of each stage (phased approach) would allow further aquifer deterioration which is not justifiable. A phased approach is warranted when there are unknowns which need to be evaluated which justify dividing the site into segments such as aqueous phase liquids, technology development or different objectives or priorities in a large site. A phase approach is being used for the Aerojet site as a whole, based on the proposal to divide the site into Operable Units, the first of which is OU-3. There is no need to further divide OU-3 into segments.

99. EPA has stated that at sites with very complex ground-water contamination problems, it may be difficult to determine whether required cleanup goals are achievable at the time a remedy selection decision must be made (EPA, 1993). Determination of restoration potential of a site may be aided by employing a phased approach to site characterization and Remediation (EPA, 1993).

<u>USEPA Response to Comment #99:</u> See Responses to Comments #97 and #98.

100. In the guidance for evaluating the technical impracticability of groundwater restoration, EPA (1993) has stated that: "A phased approach should be considered when there is uncertainty regarding the ultimate restoration potential of the site but also a need to quickly control risk of exposure to, or limit further migration of, the contamination."

<u>USEPA Response to Comment #100:</u> A phased approach would not effectively contain groundwater contamination and would not prevent further spread of contamination. See Response to Comment #98.

101. EPA (1993) further states in this guidance that: "Likewise, site remediation activities can be conducted in phases to achieve interim goals at the outset while developing a more accurate understanding of the restoration potential of the contaminant aquifer."

<u>USEPA Response to Comment #101</u>: See Responses to Comments #98 and #100.

102. As part of the presumptive remedy approach to contaminated groundwater at CERCLA Sites, EPA (1996) states that: "In general, ground-water response actions, especially those using extraction and treatment, should be implemented in more than one phase."

USEPA Response to Comment #102: The extent of contamination, the complex hydrogeology of the site and the economic and protectiveness imperatives to prevent the further spread of contamination preclude use of a phased approach at this site. See Responses to Comments #98 and #100.

103. More recently as part of guidance developed for preparation of Proposed Plans, Records of Decision, and other remedy selection documents, EPA (1999) has stated that: "Where complex ground-water contamination problems are present at a site (e.g., complex hydrogeology or non-aqueous phase liquids) it will generally be necessary to implement a phased approach toward the cleanup of that site. In a phased remedy, site response activities are implemented in a sequence of steps so that the information gained in earlier phases can be used to refine subsequent investigation objectives or actions. Ground-water response actions, in particular those using extraction and treatment, should generally be implemented in more than one phase."

USEPA Response to Comment #103: There are no non-aqueous phase liquids present off-site in OU-3. Therefore, it is not necessary to implement a phased approach for OU-3. The phased approach is being implemented by first addressing off-site groundwater contamination in OU-3, then addressing the remaining off-site groundwater contamination in Perimeter Groundwater Operable Unit, and then addressing source areas in other OUs. Because of the phased approach to overall remediation, Aerojet is not required to remediate the on-site source areas of the OU-3 groundwater plums as part of this remedy.

104. In accordance with the policies and criteria set forth in these EPA guidance documents, Aerojet believes that the remedy for the Western Groundwater OU should be implemented in a phased manner. Furthermore, for the reasons enumerated below, Aerojet believes that the most appropriate remedy for Western Groundwater OU in terms of the nine criteria set forth in the NCP and in accordance with EPA guidance related to selection and implementation of groundwater extraction and treatment remedies is Alternative 4B.

USEPA Response to Comment #104: See Responses to Comments #98, #102 and #103.

105. Aerojet believes the following factors support selection and implementation of Alternative 4B with use of a phased-approach towards possible enhancements and modifications: (1) achieving containment of the source area at the boundary of the Aerojet property, and (2) achieving containment of the downgradient edge of the existing plume so as to protect offsite water supplies.

USEPA Response to Comment #105: Restoration of the aquifer to beneficial use must be added as a third objective of the remedy. Also see Responses to Comments #98, #102 and #103.

106. A reasonable probability exists that complete restoration of the aquifer within a reasonable time frame may be technically impractical.

USEPA Response to Comment #106: Aerojet did not include a Technical Impracticability evaluation in the Feasibility Study. See Responses to Comments #1, #6 and #8.

107. The identification of perchlorate and NDMA as contaminants of concern for the Western Groundwater OU, as well as at other sites throughout California and the nation as a whole, is a very recent occurrence. Therefore, significant advances in analytical methods, toxicological information, remediation technologies and remediation experience can be expected in the near future.

USEPA Response to Comment #107. If it is appropriate, the ROD can be amended to reflect changes that will favorably impact the remedy.

108. The second RAO identified by EPA in the Proposed Plan is "achieve containment of the groundwater contamination to minimize future migration of contaminants until cleanup is accomplished." Without groundwater containment, restoration of the aquifer will never be achieved. Furthermore, without groundwater containment, spreading of the contamination will occur and water supply wells may be impacted. Consequently, the first and principal focus of the remedy for the Western Groundwater OU should be achievement of containment of the on-property source area and containment of the downgradient edge of the existing off-property plume.

USEPA Response to Comment #108: The USEPA agrees that containment should be implemented as soon as possible. Alternative 4C achieves containment at the earliest possible date by installing wells at the plume boundaries in each layer. Alternative 4B does not achieve the objective of early containment because only one D layer well is installed in 2001, and one D layer well is installed in 2011 (10 years after remedy implementation) and the remaining D and E layer wells are not installed until 2021 or 2041.

109. Use of a phased cleanup approach is warranted for the Western Groundwater OU based on the overall heterogeneity of the aquifer and contaminant occurrences. These uncertainties result in a potential for uncertain localized response of the aquifer to groundwater extraction. These uncertainties require a systematic approach to installing and testing extraction wells to evaluate the design of the containment system.

USEPA Response to Comment #109: See Response to Comments #98, #102 and #103.

110. As previously discussed, there is a realistic potential that complete groundwater restoration of the Western Groundwater OU may be technically impracticable within any reasonable time frame. Although restoration of the aquifer may eventually occur, the

time required to achieve complete restoration cannot reasonably be predicted at this point and in any event may be extremely long.

USEPA Response to Comment #110: Aerojet did not present a Technical Impracticability evaluation in the Feasibility Study. See Response to Comment #6.

111. EPA's assessments of the potential time that may be necessary to achieve restoration of the aquifer have resulted in estimates that are extremely lengthy. Even these estimates are based on numerous assumptions and uncertain input parameters which have a tremendous effect on the resultant calculations. Depending upon aquifer conditions, the actual spatial distribution and concentration of contaminants in the aquifer, and the cleanup goals ultimately selected by EPA, the estimates of the time required to achieve groundwater restoration could vary by an order of magnitude (factor of ten) or more. Actual time for restoration cannot be predicted with any degree of accuracy or certainty.

USEPA Response to Comment #111: See Responses to Comments #8 and #14.

112. Assuming that simply installing and extracting groundwater from additional wells will somehow decrease the overall time fails to reflect the limitations that may be imposed by the aquifer characteristics, the limitations and simplifying assumptions of the various groundwater models employed to develop the time estimates, and the technical limitations of the pump and treat technology. Unrealistic expectations regarding the potential for groundwater restoration, the time required to achieve restoration and the assumption that by simply pumping more water will decrease the time required for restoration is the type of thinking that led EPA to develop the various guidance documents related to technical impracticability of groundwater restoration, presumptive remedy for groundwater extraction and treatment, and limitations of pump and treat technology cited above. EPA's answer to these issues was to encourage use of a phased approach to groundwater extraction remedies.

USEPA Response to Comment #112: See Response to Comments #1, #6, #10, #11, #14, #98, #102 and #103.

113. There are still many uncertainties regarding the detection, treatment, and toxicity of perchlorate and NDMA because these chemicals are not common. As a result, information regarding many fundamental aspects of the occurrence, effects and remediation of these constituents is still lacking. Based on ongoing efforts, significant advances in analytical methods, understanding of the toxicological effects, remediation technologies, and remediation practice and experience can be expected in the next few years.

Although perchlorate has now been identified as a contaminant of concern at numerous locations through California and the nation, long-term operating history for treatment of perchlorate to the low cleanup goals proposed by EPA has only been achieved at one

treatment facility in the nation, the GET E/F facility at the Aerojet Rancho Cordova site. Aerojet has expended several years worth of effort and invested millions of dollars to develop and implement this treatment process at one of their groundwater containment facilities. Other water treatment equipment manufacturers such as Calgon are currently involved in developing large-scale operating history with the ion exchange technology for treatment of perchlorate.

USEPA Response to Comment #113: Comment noted.

114. In the case of NDMA, the cleanup goals proposed by EPA cannot be reliably detected. The State of California originally proposed an action level of 2 ppt for NDMA, but subsequently adopted a temporary action level of 20 ppt as a result of the lack of demonstrable laboratory capabilities of reliably and reproducibly achieving a detection limit of 2 ppt for NDMA.

USEPA Response to Comment #114: See Responses to Comments #15, #16 and #25.

115. Quarterly evaluations conducted by Aerojet (Exhibit IV-3 NDMA Analytical Methods Evaluations Reports) indicate that although several laboratories may claim that they can achieve a detection limit of 2 ppt, results of analyses of blind samples submitted by Aerojet demonstrate that this ultra-low level can either not be achieved or cannot be achieved in a reliable and reproducible manner. Furthermore, even if a laboratory could reliably achieve and reproduce results at a detection limit of 2 ppt, this level is still greater than the 1.3 ppt proposed by EPA as the cleanup goal for the Western Groundwater OU.

USEPA Response to Comment #115: See Responses to Comments #15, #16 and #25.

116. Over the last few years, Aerojet pioneered development and application of biological treatment techniques for removal of perchlorate from groundwater. Calgon recently completed demonstration of the applicability of the ion exchange processes for removal of perchlorate from groundwater and just recently received DHS approval to allow for direct potable reuse of water treated by this method. Other vendors are involved in application of various advanced oxidation techniques for treating NDMA to extremely low levels in water. Clearly, numerous advances in the science of laboratory analyses, toxicology, treatment technologies and remediation practices and experience can be expected in the next few years relative to perchlorate and NDMA occurrences in groundwater. For example, Aerojet is involved with development and demonstration of an in-situ biological process for treatment of perchlorate. Such advances may present numerous alternative methods for the remediation of these compounds. The evolving nature of remediation practices for perchlorate and NDMA present a compelling argument for use of a phased approach to the Western Groundwater OU.

USEPA Response to Comment #116: See Response to Comments #98, #102 and #103.

117. Based on these factors, Aerojet believes that selection of Alternative 4B with a phased approach towards potential future enhancements or modifications that may be shown to be beneficial for achievement of groundwater restoration not only (1) best meets the nine criteria for selection of a remedy under the NCP, but (2) is consistent with EPA guidance relative to groundwater remedies at Superfund sites and accepted scientific methods and practices for groundwater remediation.

USEPA Response to Comment #117: Alternative 4B is not preferable to alternative 4C as discussed below.

Alternative 4C is more protective than 4B because it contains the plumes in Layers D and E the earliest thus, protecting more of the aquifer.

Alternative 4C restores the aquifer to beneficial use in accordance with the NCP and the State RWQCB (Central Valley) Basin Plan.

Alternative 4C will be more effective in reducing the volume of contamination than Alternative 4B because more contamination will be removed by Alternative 4C. Alternative 4B results in less contaminant mass/volume removal because contamination is allowed to spread into uncontaminated areas of the aquifer; this will result in a greater area that is remediated only to the cleanup levels (leaving contamination below cleanup levels in areas not presently contaminated) and also will result in unrecoverable contamination left behind in pore spaces in areas not presently contaminated. Alternative 4C also begins removing contaminant mass in Layers D and E sooner than Alternative 4B.

Alternative 4C has better Short-Term effectiveness because cleanup will be achieved in less time, thus posing less Short-Term risks and prevents the spread of contamination into areas of the aquifer (layers D and E) that are not presently contaminated.

Alternative 4B is not consistent with the NCP or with USEPA guidance relative to groundwater remedies because this alternative allows uncontaminated portions of Layers D and E to be contaminated since the extraction wells are not placed at the current plume boundaries.

LIST OF SPECIFIC COMMENTS ON THE PROPOSED PLAN FOR OU-3

118. **Terminology throughout entire document** - The phrases "remedial action objectives", "proposed cleanup levels", and "cleanup standards" are used throughout the text and tables of the Proposed Plan and appear to be used synonymously. Please define these phrases.

USEPA Response to Comment #118: Remedial action objectives describe what the proposed site cleanup is supposed to accomplish. This term is not

synonymous with the other two terms because more than cleanup levels are involved. Proposed cleanup levels are the concentrations which must be reached by groundwater remediation. Reaching cleanup levels is one of the remedial action objectives. The term "Cleanup Standards" may refer to site-specific cleanup levels or to more general requirements like Maximum Contaminant Levels.

119. **Page 3: "To reinject or not to reinject…" sidebar –** The discussion of reinjection does not acknowledge that reinjection would also greatly reduce the estimated time required to restore the beneficial use of the offsite aquifer. This is clearly demonstrated by EPA's duration estimates associated with the various alternatives as summarized in Table 2 on page 9 of the Proposed Plan. All of the "A" alternatives have estimated durations that are significantly shorter than the non-reinjection alternatives. The only exception presented on Table 2 is the reported difference in the estimated durations of Alternatives 4A and 4C; however, as presented in the General Comments and the Geotrans discussion of the use of the groundwater flow model, the reported difference between Alternatives 4A and 4C is insignificant.

USEPA Response to Comment #119: It is not true that all of the reinjection alternatives have shorter durations than Alternative 4C; the duration of alternatives 5A and 5B is longer then the estimated duration of Alternative 4C. The difference in duration between Alternatives 4A and 4B is only 2.5% of the estimated time; this is insignificant.

120. **Page 5: "Direct vs. indirect reuse of treated water" sidebar –** See discussion in the General Comments. EPA should consider retaining all potential alternate water supply contingencies.

USEPA Response to Comment #120: USEPA has retained all potential alternative water supply contingencies. See Response to Comment #4.

121. **Page 7: Table 1: Chemicals of Concern in Groundwater –** As discussed in General Comment Number 2, there are differences in chemical occurrence and distribution between the on-site and off-site groundwater plumes. The presentation in the Proposed Plan does not make this distinction.

USEPA Response to Comment #121: By necessity, the Proposed Plan contains an abridged and simplified version of the Remedial Investigation Report and relevant portions of the Feasibility Study. If appropriate, this distinction will be made in the ROD, where the length and space limitations will not impact the presentation. Also see Response to Comment #19.

122. **Page 7: Table 1: Chemicals of Concern in Groundwater and first paragraph on page 9** regarding proposed cleanup goals for all 15 chemicals of concern in order to comply with ARARs – The cleanup goals for Perchlorate and NDMA and the low end of the range for VOCs presented in the Proposed Plan are below the levels necessary to

achieve protection of human health and for compliance with ARARs. Further, they are below the currently achievable laboratory detection limits and present numerous other technical impracticability concerns along with significant cost-benefit implications. The proposed cleanup goals for OU-3 that are below drinking water standards have not been adequately evaluated for the technical and economical feasibility of achieving these goals.

USEPA Response to Comment #122: See Responses to Comments #15 and #16.

123. **Page 8: Remedial Action Objective No. 4 –** As discussed in the General Comments, the remedy for OU-3 is not intended or expected to "restore on-property western groundwater to beneficial uses".

USEPA Response to Comment #123: This is not true. Restoration to beneficial uses is required by the NCP and the Water Board's the Central Valley Region Basin Plan. See Response to Comment #1.

124. **Page 8: Figure 4** – The title of this figure says "Preferred alternative well locations." It appears that several of the extraction wells for Alternative 4C2 (as described by EPA) are missing from this figure. This raises questions about how the estimated costs for this remedy were derived and what components are included in the remedy.

USEPA Response to Comment #124: This figure was taken from the Feasibility study. A single modifying note was added by USEPA. The corrected figure is attached. The estimated costs include all of the Alternative 4C2 extraction wells.

125. **Page 9: First Full Paragraph, Second Sentence and Table 1 note at bottom of table referring to the * symbol** – This sentence and the note in Table 1 indicate an expectation that by achieving the cleanup goal for Perchlorate, and to some extent NDMA, the selected remedy will also achieve the lower range of the remedial action objectives for VOCs. See discussion under General Comment 2.

USEPA Response to Comment #125: See responses to discussion under General Comment 2 (Responses to Comments #16 through #53).

126. **Page 9: First Paragraph under "Preferred Alternative"** – The text states that the preferred alternative provides for discharge of approximately 7,000 gallons per minute (gpm) of treated groundwater to Buffalo Creek. The description of Alternative 4C in the Feasibility Study indicates that approximately 9,975 gpm would be discharged to Buffalo Creek. While specific backup has been requested of EPA regarding the actual number of extraction wells and associated flowrates included with the Alternative 4C presented in the Proposed Plan; Aerojet estimates that greater than 10,000 gpm would be discharged under this alternative.

USEPA Response to Comment #126: The additional wells would result in approximately 1950 additional gallons per minute. Note that an additional 1400 gallons per minute have also been added to Alternative 4B.

127. **Page 9: Table 2: Cost Comparison** – As discussed under General Comment 3, costs for direct and indirect reuse of treated groundwater should not be included on this table. The notes at the bottom of the table should indicate that present worth costs are used for remedy selection.

USEPA Response to Comment #127: See Response to Comment #61. Costs for direct discharge to the drinking water system and surface water discharge must be specified; the table was the best place to accomplish the task.

128. **Page 10: Third Paragraph under "Evaluated Alternatives" –** The references to Figure 3 on page 4 of the Proposed Plan included in this paragraph are incorrect. The paragraph discusses the layout of various extraction wells and therefore should actually refer to Figure 4 on page 8 of the Proposed Plan. Also, the text that describes Alternative 4C is not consistent with the number of wells implied by the costs provided in Table 2.

USEPA Response to Comment #128: Comment noted. The description of Alternative 4C will be revised for the ROD.

129. **Page 10: Fifth Paragraph under "Evaluated Alternatives" –** Alternative 4 variations are described in the text as including new off-site extraction wells, containment of the plume, and "restoration of contaminated groundwater". As discussed in General Comment 1, the Alternative 4 variations as described in the Feasibility Study were intended as containment remedies, not as restoration remedies.

USEPA Response to Comment #129: See Response to Comment #1.

130. **Page 10: Fifth Paragraph under "Evaluated Alternatives" –** Alternative 4C as costed in the Proposed Plan appears to include at least four to six additional extraction wells in Layer C over and above the number of extraction wells described in the text on page 10 and shown in Figure 4 on page 8.

USEPA Response to Comment #130: Alternative 4C costs include nine Layer C extraction wells and one Layer D extraction well beyond the description in the text. Alternative 4B costs also include five Layer C extraction wells and two Layer D extraction wells beyond the text.

131. **Page 11: Description of Alternative 4C in first column** – The description of Alternative 4C indicates "optimal" well placement. As discussed in General Comment 3 under the long-term effectiveness discussion, Aerojet does not agree that placement of the wells under Alternative 4C represents "optimal" placement. Therefore, the word "optimal" should be removed.

USEPA Response to Comment #131: The placement of the Alternative 4C wells in the Feasibility Study and Proposed Plan is part of the conceptual design of this remedy. A conceptual design is not necessarily the same as the remedial design. The actual locations of the extraction wells will be optimized during the Remedial Design Phase.

132. **Table 3: Comparison of Alternatives** – See discussion under General Comment 3 with respect to the factors evaluated under the Reduction in Toxicity, Mobility, Volume and Short-Term Effectiveness criterion.

USEPA Response to Comment #132: See Responses to Comments #55 through #86 and #117.

133. **Table 3: Comparison of Alternatives and Page 13:** under "Cost" discussion – In accordance with EPA Guidance (USEPA, 2000), present worth cost estimates only, rather than total lifetime non-discounted cost, should be used for remedy selection as discussed in General Comment 3.

USEPA Response to Comment #133: See Response to Comment #61.

134. **Page 12: Under heading "Reduction in Toxicity, Mobility and Volume"** – See discussion under General Comment 3. Alternatives 4B and 4C should be ranked equally for this criterion because time until restoration or cleanup is not a factor to be considered for this criterion according to CERCLA guidance.

USEPA Response to Comment #134: USEPA strongly disagrees with this comment. See Responses to Comments #69 and #117.

B. Responses to Comments from Geotrans

135. EPA's determination that Alternative 4C will achieve groundwater restoration in a significantly shorter period of time than Alternative 4B is based on arbitrary and unsupported assumptions and the uncertainties associated with EPA's projections preclude their use as a basis for remedy selection. EPA has selected OU-3 FS Remedial Alternative 4C over Alternative 4B on the belief that their calculated clean-up time frame differential between these two alternatives is accurate and sufficient to justify selection of the more expensive remedy.

USEPA Response to Comment #135: Aerojet did not provide an estimate of remedy duration in the Remedial Investigation/ Feasibility Study (RI/FS). Aerojet provided the approximate percent of area captured by layer within a 25-year evaluation period, which does not meet USEPA's requirement to estimate the life of the remedy. This left USEPA with the task of preparing estimates of the time required to achieve groundwater cleanup for the remedial alternatives. Aerojet prepared a groundwater flow model for evaluating the remedial alternatives in

the RI/FS. USEPA could have chosen to prepare a new groundwater model or to use the existing model that had already been developed for the site. USEPA chose an approach that would use the existing flow model developed specifically for the site and extended the use of the model beyond the 25 year time frame used by Aerojet in the RI/FS by using the longer time frames already established in the model files by Geo Trans. These longer time frames were already part of the model, but Aerojet chose to only report model results for a 25-year period, which did not meet either the 30-year remedy evaluation required for Feasibility Studies or USEPA's requirement that the total remedy duration be estimated. The use of the model, particle tracking and particle capture analysis was fundamentally similar to that performed by Aerojet/GeoTrans in the RI/FS except that the model simulations were extended for 100 years or more. Use of the existing model, paralleling and extending the modeling, methods already documented in the RI/FS was a cost and time effective approach. The USEPA believes use of the model to predict remedy duration was reasonable considering the time and resources already invested in the groundwater model by Aerojet/GeoTrans.

Many simplifying assumptions had been made in developing the original groundwater flow model for what is a complex groundwater system. Although this flow model is a very general representation of the groundwater system, it is an appropriate tool for comparing the alternatives and the only tool currently available to predict remedy duration. The model is an acceptable approach for comparing remedial alternatives because the groundwater system remains the same and the only variation is the performance of the extraction system.

USEPA did not modify the underlying groundwater flow model developed by Aerojet's consultant. The only modification made by USEPA was to add several extraction wells in evaluating Alternative 4C. In general, the model results show that remedy durations will be long for all of the alternatives and that there can be significant hydraulic performance differences between remedial alternatives. The differences in hydraulic performance suggest differences in remedy duration, which are valid to use in evaluating the remedial alternatives. The USEPA selected of Alternative 4C, in part, because the model results indicated that groundwater contamination will be removed from Layers D and E in a significantly less time than the well configuration in Alternative 4B would achieve. In addition, Alternative 4C will minimize the lateral extent of groundwater contamination in Layers D and E because extraction wells will be placed at the leading edge of the plume in each layer. In Alternative 4B, groundwater extraction from Layers D and E will only begin after a large additional volume of Layers D and E has been contaminated.

136. The EPA calculated time frames are based on its interpretation of the combined results of a batch flushing analytical model and the numerical groundwater flow model developed by Aerojet to evaluate alternative well locations for hydraulic containment. The EPA calculation also assumes that perchlorate is the contaminant of concern with respect to

groundwater restoration. The EPA-calculated time differential is not accurate, and it is based on unsupported arbitrary assumptions or approximations that exaggerate the clean-up time differential between the two remedial alternatives. Consequently, the EPA-calculated time differential is not a sufficient or reliable basis for remedy selection.

USEPA Response to Comment #136: Estimating groundwater restoration times is generally not difficult. The challenge is to develop a reliable estimate for a complex site like Aerojet when groundwater cleanup goals will not be achieved for many years in the future. The methodology used by the USEPA is well documented and has been used at numerous sites. Although Aerojet has criticized the USEPA's approach it has not proposed an alternative approach in compliance with USEPA guidance. The USEPA believes the methodology it used to evaluate the remedial alternatives and to estimate remedy duration was appropriate to compare the alternatives and was the only practical tool currently available to predict remedy duration. The USEPA does not agree that the calculated time differential between remedial alternatives is exaggerated or that the data was manipulated to support one remedial alternative over another. The results of the model analysis clearly show that there are differences between the remedial alternatives.

Three chemicals of concern, perchlorate, NDMA and TCE, were evaluated to estimate time frames for groundwater restoration. Perchlorate was emphasized because: (1) the extent of groundwater contamination due to perchlorate is greater than the extent of contamination due to TCE and NDMA, (2) perchlorate is found at higher concentrations than TCE and NDMA and (3) perchlorate has a lower cleanup concentration than TCE.

137. There are two basic components to EPA's cleanup time calculations. The first component is the number of pore volumes required to reduce concentrations in groundwater to an acceptable level, and the second component is the time required to complete one pore volume flush of the contaminated groundwater region. The EPA has estimated that the groundwater flow model calculations indicate an 18-year differential between Alternative 4C and Alternative 4B for the time required to complete one pore volume flush. EPA multiplied the 18 year differential for one pore volume flush by 6 to conclude that Alternative 4C would achieve cleanup 108 years sooner than Alternative 4B. A batch-flushing model provided the basis for the 6 pore flushes; however, the assumptions included in the model are unsubstantiated. The following sections address the two components of EPA's calculations separately.

USEPA Response to Comment #137: The "batch flushing" model is a standard method for estimating cleanup times. Also see the Response to Comment 5.

138. In addition, the groundwater flow model included in the RI/FS and used by EPA to calculate cleanup times was intended solely to evaluate potential well placements and estimated flow rates to be used as a basis for the cost analysis. This model was neither

developed nor calibrated to assess the number of pore flush volumes or the time required to achieve the low concentration cleanup goals proposed by EPA.

<u>USEPA Response to Comment #138:</u> The comment implies that there is a significant difference between a model developed to "evaluate potential well placements" and a model to assess the number of pore flush volumes. The groundwater model developed for Western Groundwater OU RI/FS was documented in Appendix D of the Remedial Investigation/Feasibility Study (RI/FS). The stated objectives of the groundwater flow model were to (1) simulate groundwater flow conditions within and around the Rancho Cordova area and (2) simulate the effects of remedial alternatives under assumed future hydrologic conditions to allow further evaluation of alternatives.

The USEPA seriously doubts that a model developed to assess the number of pore flush volumes or the remedy duration would look much different than the model Aerojet prepared for the RI/FS. USEPA could have chosen to prepare a new groundwater model or use the existing model that had already been developed for the site. USEPA chose to use the existing flow model developed specifically for the site and extended the use of the model beyond the 25 year time frame used by Aerojet/GeoTrans in the RI/FS by using the longer time frames already established in the model files by Geo Trans. These longer time frames were already part of the model, but Aerojet chose to only report model results for a 25-year period, which did not meet either the 30-year remedy duration required for Feasibility Studies or USEPA's requirement to estimate the time required to meet remedial action objectives. The use of the model, particle tracking and particle capture analysis was fundamentally similar to that performed by Aerojet/GeoTrans in the RI/FS except that the model simulations were extended for 100 years or more. Use of the existing model paralleling and extending the modeling methods already documented in the RI/FS was a cost and time effective approach.

139. <u>Number of Pore Volumes Flushes Required to Achieve the Required Clean-up Concentration</u> – The EPA-estimate of the number of pore volume flushes required to reduce groundwater concentrations of perchlorate to an acceptable level is very-loosely based on the batch flushing model (EPA, 1994) represented by Equation 1:

$$Npv = -(R_f * \ln (C_{final}/C_{initial})) \quad (1)$$

where:

Npv	is the number of pore volumes,
R_f	is a retardation factor,
C_{final}	is the final concentration
$C_{initial}$	is the initial concentration

For their calculations EPA made the following assumptions: a retardation value of 5.3, a final concentration of 4 or 18 ug/l, and an initial concentration of 90 ug/l for perchlorate. Using these parameter values resulted in a calculated number of pore volume flushes of 16.5 and 8.5. EPA then decided that they would base their subsequent calculations on six pore volume flushes, based on "duration of remedy and the rapid development of new technology" (EPA, 2000). This decision reflects the arbitrary nature of the EPA evaluation and demonstrates that the calculations are not a reliable basis for decision-making.

USEPA Response to Comment #139: USEPA calculated and used a retardation factor of 5.3 for perchlorate in calculating pore flushing volumes. Without any corroborating evidence GeoTrans stated that, based on the chemical nature of perchlorate, a retardation factor of 1 is more realistic. Very few chemical contaminants in groundwater can be modeled with a retardation factor of 1. Also, in Table A-2, GeoTrans proposed retardation factors of 2.1 and 1.2 for TCE and NDMA, respectively. A retardation factor of 2.1 for TCE appears to be inappropriate for purposes of estimating cleanup times and transport velocities. The retardation factors used in USEPA's analysis are reasonable, documented and conservative. A K_d value for NDMA was not available, so NDMA was not considered in USEPA's calculation of the pore flushing volumes.

The retardation rate is the ratio of the groundwater velocity to the rate that chemicals migrate in the groundwater. Sorption processes are the primary mechanism for retarding contaminant migration through an aquifer. The USEPA calculated the retardation factor using the procedure described below. The retardation factor is estimated using the following equation

$$R = 1 + K_d (p_b/n)$$

where: R = retardation factor
p_b = bulk density of the aquifer
K_d = distribution coefficient
n = porosity

There is limited information on the K_d for perchlorate. USEPA (Susarla et al, 1999) reports a range of K_d for perchlorate of 0.76 to 1.25 Kg/L. The K_d value for TCE was obtained from USEPA (EPA, 1998).

Using the following K_d values the retardation factor can be calculated using the equation above.

K_d of perchlorate	*0.76 to 1.25 L/kg*
K_d of TCE	*1.8 L/kg*
Bulk Density	*1.7 Kg/L*
Porosity	*0.3*

Therefore using the formula for retardation rate provided above:

Perchlorate	*For K_d of 0.76*	*R =5.3*
	For K_d of 1	*R = 6.7*
	For K_d of 1.25	*R = 8.1*
TCE	*For K_d of 1.8*	*R = 11.2*

Using the lower reported K_d value, the retardation factor for perchlorate was calculated to be 5.3. This is the value that was used in USEPA's analysis. Use of a higher value would have increased the remedy duration estimates. The K_d for TCE is primarily a function of the amount of organic carbon present in the aquifer. If there is little organic carbon in the aquifer, a retardation factor of 6 is within the lower limit of reported K_ds for TCE. A retardation factor of 2.1 for TCE, as used in the GeoTrans analysis, seems unreasonably low based on a review of literature values used for this type of analysis. (*Susarla, S, et al. 1999. Adsorption and desorption characteristics in soils. EPA. NERL, Athens, GA and EPA. 1998, Technical Protocol for Evaluating Natural Attenuation of chlorinated solvents in Ground Water. EPA Document 600-R-98-128*)

140. The EPA selection of a retardation factor of 5.3 for perchlorate is unexplained and not realistic. Unlike trichloroethylene (TCE), which is an organic compound that partitions to aquifer solids, and whose transport through groundwater is retarded with respect to groundwater velocity, perchlorate is an inorganic salt that does not partition to the solid phase. A more realistic retardation factor for perchlorate would be 1.0 rather than 5.3. This arbitrary specification by EPA has a significant effect on the results of the batch flushing model calculations. As discussed in the comments on the Proposed Plan, EPA has assumed that the lower cleanup goals for the volatile organic compounds (VOCs) will be achieved through achievement of the perchlorate cleanup goal. However, this assumption is greatly influenced by the use of an inappropriate retardation for perchlorate. If the appropriate retardation factor of 1.0 is used, the cleanup time is no longer controlled by perchlorate, but instead is a function of the time required for removal of TCE.

<u>USEPA Response to Comment #140</u>: Documentation of the retardation values for perchlorate and TCE that were used in USEPA analysis was provided in the Response to Comment 5. GeoTrans did not provide a scientific basis to support the lower retardation values for TCE and perchlorate in its comment.

141. The initial chemical concentrations in the aquifer assumed by EPA in their modeling effort are also inappropriate for use in estimating cleanup times and greatly affect the model outcome. The initial concentration that EPA specified for their modeling effort was based on an assumed concentration of 90 ug/l of perchlorate through the entire plume. EPA's use of a single uniform concentration through the plume area is presumed to represent complete mixing of the groundwater, which is a requirement of the batch-flushing model. Review of the various plume maps presented in the RI/FS report indicates that the perchlorate concentration in Layer C varies from 4 to 4,000 ug/l with

the vast majority of the plume area containing levels of 400 ug/l or more. Use of a uniform 90 ug/l initial concentration is inconsistent with the available data and will result in an underestimate of the number of pore volume flushes required to achieve the cleanup goals. Furthermore, use of a uniform concentration incorrectly increases the perceived differences in estimated cleanup times between Alternative 4B and 4C2.

USEPA Response to Comment #141: USEPA analysis of the flushing rates for Alternatives 4B and 4C indicates that in general the highest flushing rates occur in areas with highest groundwater concentrations and the lowest flushing rates occur in areas with lowest groundwater concentrations. In most remediation systems, it also takes longer to capture groundwater with the lowest contaminant concentrations. Therefore, it was useful to evaluate the minimum flushing volumes required to meet cleanup goals assuming that the most difficult areas to reach the cleanup goals would be areas least influenced by pumping. This assumption was necessary to simply our remedy duration calculations.

142. The EPA decision to use a retardation factor of 5.3, as opposed to a more realistic number significantly increases the calculated number of pore volumes. In addition, the number of pore volumes is sensitive to the cleanup goal. For example, using a retardation factor of 1 and a cleanup goal of 32 ug/l in equation (1) results in a calculated number of pore volume flushes of 1. It is obvious that the greater the number of pore volume flushes required for clean up, the greater the time differential between the two alternatives. It is clear that there is no valid basis for EPA to reach the conclusion that 6 is the correct number of pore flushes.

USEPA Response to Comment #142: See Response to Comments #139 and #141. The use of six pore volumes was not intended to represent the maximum number of pore volumes required to meet cleanup goals but rather to suggest a minimum number of pore volumes that might be necessary to achieve cleanup.

143. Time Required to Complete One Pore Volume Flush – EPA has calculated a time differential of 18 years between Alternative 4C and 4B to complete one pore volume flush of the region of contaminated groundwater. They have reached this conclusion by misapplying particle-tracking calculations based on the three-dimensional numerical groundwater flow model developed by Aerojet. EPA arbitrarily defined one pore volume flush to be equated to removal of 90 percent of the "particles" used to define the region of perchlorate-contaminated groundwater. They chose a number less than 100 percent based on the assumption that optimization of extraction well locations could be done during remedial design. This was an arbitrary selection that has a significant effect on model-calculated cleanup time. If, for example, equally valid arbitrary assumptions of 70, 75, or 80 percent particle removal had been made, then the calculated time differential between Alternatives 4C or 4B would have been 8, 9, and 14 years.

USEPA Response to Comment #143: The USEPA evaluated using 100 percent or 90 percent of particle capture times to define a one pore volume flush. The difference in times between 90 percent and 100 percent particle capture time

was greater than 100 years for several of the alternatives. This occurred because the last 10 particles took an extremely long time to be captured; this appears to be a peculiarity of this model as all alternatives were impacted. Optimization of well locations and specifications during design would likely improve capture. Therefore, USEPA chose 90 percent of particle capture as representative of the time to complete a single pore volume flush. Lower percentages were not chosen because they were not close to 100%. All of the 4 and 5 series alternatives were evaluated using 90 percent of particle capture, so all of the alternatives were treated in the same way. This was done so that no alterative received preferential treatment.

144. Inappropriate Use of the Groundwater Model – The intended use of the groundwater model presented in the RI/FS was to evaluate the well locations and pumping rates needed to achieve containment and to estimate, for costing purposes, chemical concentrations entering remedial wells. The model was not developed or calibrated to allow for assessment of the number of pore flushes, or the time required to achieve restoration.

As such, EPA should not use the flow model to calculate clean-up times.

USEPA Response to Comment #144: USEPA used the existing groundwater flow model prepared by Aerojet to evaluate the hydraulic performance of the remedial alternatives. The USEPA believes use of the model to predict remedy duration was reasonable considering the time and resources already invested in the groundwater model by Aerojet and GeoTrans. In general the model results show that remedy durations will be long for all of the alternatives and that there can be significant hydraulic performance differences between remedial alternatives. The differences in hydraulic performance suggest difference in remedy durations, which are valid to use in evaluating the remedial alternatives. The number of pore flushes, and hence the time required to achieve remediation were not assessed using this model, but were estimated using the batch flush model.

145. The model was developed based on generalized aquifer properties and does not adequately reflect the aquifer heterogeneities that are present. Specifically, the model was based on the following assumptions:

Generalized aquifer layers, while allowing for adequate estimation of flow to a pumping well, are not sufficient to describe the flow of chemicals to a pumping well; and

Aquifer heterogeneities have a profound affect on the migration of chemicals. EPA attempts to take the effects of heterogeneities on chemical migration into account with their pore flush model. However, this model also generalizes the complex transport processes that occur in the aquifers at the site.

USEPA Response to Comment #145: Many simplifying assumptions had been made by Aerojet/GeoTrans to develop the original groundwater flow model for a complex groundwater system. Although this flow model is a very general representation of the groundwater system, it is an appropriate tool for comparing the alternatives and the only tool currently available to predict remedy duration. The model is acceptable for comparing remedial alternatives because the groundwater system remains the same and the only variation is the performance of the extraction system in each alternative.

146. In addition, various solute transport effects are not simulated by the flow model. Specifically, the advective flow simulated by the model cannot account for natural attenuation of chemical concentrations. Attenuation likely will occur at the site and will affect significantly the distribution of chemicals with time.

USEPA Response to Comment #146: A solute transport model would have been useful to evaluate the remedial alternatives. Unfortunately, Aerojet chose not to develop a solute transport model. USEPA believes that relative comparison of the remedial alternatives using a solute transport model would be consistent with the results of the analysis of remedial alternatives using the existing approach and model.

147. In general, the uncertainty of predictions increases with increasing simulation time. Typically, uncertainty increases significantly when predictions are made beyond a period of time equal to twice the calibration period. Since the calibration period is 15 years, predictions of conditions 30 years into the future are not reliable.

USEPA Response to Comment #147: USEPA agrees that the uncertainty of the predication increases with increasing simulation time although we question the practical usefulness of limiting model predictions to no more than twice the calibration period. USEPA has not seen this limitation in the literature or in other groundwater models. If the twice the calibration limitation was implemented, then groundwater modeling would be limited to a very few sites, because model calibrations are frequently based on a year or less of data. Because Aerojet/GeoTrans used the model to predict conditions 25 years in the future, it seems unlikely that extending the model for an additional 5 years (from 25 years to 30 years), or even to 60 years or more, would result in less reliable data than that used by Aerojet in the FS.

148. Reevaluation of "Duration" Following EPA Methodology – As noted earlier, the design of the Western Groundwater flow model limits its use in evaluating time to aquifer restoration in order to compare remedial alternatives within the framework of the remedial selection criteria of the National Contingency Plan. Questions regarding the formulation of the batch flush model to refine an estimate for aquifer restoration have been raised previously in this discussion. The application of the batch-flushing model is called into question, further due, to how movement of chemical plumes has been generalized by EPA.

In calculating time to restoration using the batch flush model, EPA considered removal of chemical plumes as a whole, disregarding segregation of the plumes by layer. The fact that the distribution and concentrations of chemicals vary widely among the three- water bearing layers at the site is significant and warrants consideration if the batch flush model were to be applied. This is particularly so since the largest extent of chemicals in area and mass is within Layer C.

USEPA Response to Comment #148: USEPA did evaluate relative cleanup times of the plumes by layer; this information was provided to Aerojet. These results do indicate that there was a 4-year difference in cleanup times for Layer C between Alternatives 4B and 4C for one pore volume. The primary difference in cleanup times occurs in Layers D and E. Alternative 4C is more effective in removing contaminated groundwater from Layers D and E than Alternative 4B; this occurs because the Alternative 4C extraction wells are placed near the current extent of the contaminant plumes. When capture of Layers D and E is included, there is an 18 year difference in the time to capture one pore volume between Alternatives 4B and 4C. Capture of one pore volume in Alternative 4B takes longer because the contaminant plumes are first allowed to migrate to the wells placed at the current extent of the C layer plume before extraction begins or is effective in removing contaminants.

149. Tables A-1 and A-2 summarizes the results of batch flush modeling that considers migration within and restoration of each hydrostratigraphic layer for Alternatives 4B and 4C2, respectively. The longest cleanup times occur in Layer C for both alternatives and the time to reach cleanup goals in Layer C should drive the remedy lifetime. Table A-3 presents a comparison of estimated cleanup times in Layer C for Alternatives 4B and 4C2. The data presented in this table show that the time for restoration between Alternative 4B and Alternative 4C2 for Layer C, where the vast majority of chemicals reside, is approximately nine percent. Considering the uncertainty generated by the assumptions and application of the batch flush model, this nine percent difference cannot be considered significant.

USEPA Response to Comment #149: Although USEPA and GeoTrans differ in assigning initial concentration values and retardation factors for perchlorate and TCE (see above), there are several areas of agreement. A comparison of the original USEPA analysis and Tables A-1 and A-2 support the following conclusions.

- *Cleanup times for both Alternatives 4B and 4C are very long (greater than 200 years).*
- *Cleanup times for Layer C are shorter for Alternative 4C than Alternative 4B; the difference is less than 20%.*
- *Cleanup times for Layers D and E are significantly shorter for Alternative 4C than for Alternative 4B.*

150. Another shortcoming of the batch flush model is that it considers migration of perchlorate as the governing factor in time to restoration. This generalization does not account for the migration of other chemicals within the more extensive perchlorate plume that may have a greater impact on aquifer restoration. TCE, due to its greater affinity to absorbed to subsurface geologic material, will migrate at one-half the rate as perchlorate and would thus be more likely to govern time to restoration than perchlorate. Considering the migration of only one chemical in a co-mingled plume of several chemicals further calls into question the application of the batch flush model to calculate time to restoration.

USEPA Response to Comment #150: The relative retardation rates for TCE (11.2) and perchlorate (5.3) were considered in USEPA analysis.

151. Conclusions – In conclusion, the Western Groundwater flow model is adequate for its intended purpose, which was to locate extraction wells and identify pumping rates to hydraulically control the chemical plumes at the site. A generalized flow model can achieve this goal. A generalized model cannot provide chemical migration information to represent clean-up times accurately.

The EPA conclusion that Alternative 4C would achieve cleanup 108 years faster than Alternative 4B is based on a series of mathematical manipulations that are not representative of site conditions. The input parameters and underlying assumptions are arbitrary and exaggerate the calculated time differential between the two remedial alternatives. The arbitrary and unrealistic nature of the input parameters and calculation assumptions precludes the use of the calculations as a basis for remedy selection.

USEPA Response to Comment #151: USEPA used the existing groundwater flow model prepared by Aerojet. The model was developed by Aerojet to simulate groundwater flow conditions at the site and to evaluate the remedial alternatives. The USEPA used this model to compare the relative hydraulic effectiveness of the various remedial alternatives. Aerojet used the same model to compare the remedial alternatives for the first 25 years of operation. USEPA analysis extended the time frame for more than 100 years of operation, but the USEPA did not modify the model to achieve this because the time frames were already included in the Aerojet/GeoTrans model. The results of this analysis indicates that Alternative 4C removes contamination from Layer D and E in shorter time frame because groundwater extraction begins many years earlier in these layers under Alternative 4C than in Alternative 4B. The flushing rate estimates from the groundwater flow model times were combined with the results of the batch flushing analysis to indicate that overall time for any of the remedial alternatives to attain the cleanup goals will be very long (on the order of hundreds of years).

The groundwater model was used in a manner that is consistent with the use of groundwater models at other similar sites. In general, the model results shows that remedy duration will be long for all of the alternatives and that there can be significant hydraulic performance differences between remedial alternatives.

The model indicates that Alternative 4C is somewhat more effective than Alternative 4B in flushing contaminated groundwater from Layer C. The model results indicated that Alternative 4C is much more effective than Alternative 4B in flushing contamination from Layers D and E. The differences in hydraulic performance between Alternatives 4B and 4C suggest differences in cleanup times, which are valid to use in evaluating remedial alternatives.

C. Responses to Oral Comments Received During the December 7, 2000 Public Meeting

PLUME BOUNDARIES

152. **UNIDENTIFIED AUDIENCE MEMBER**: That blue line goes closer over to the American River, et cetera, where wells are out to here. You have been missing the homes over there.

153. **MS. DOVE**: Now you answered that the plume has crossed the American River. Is that being monitored? And is that being measured? And if so, by whom and what are the results?

154. **MS. DOVE**: Considering it crossed the river, is anybody measuring that which is picked up by the River?

155. **UNIDENTIFIED AUDIENCE MEMBER**: They are listed, but it is not - I mean, over there it shows an area of shading of where all the contamination's at, but you don't have it including where all the contaminated wells are at. You are giving a false conclusion that it hasn't spread as far as it has.

156. **UNIDENTIFIED AUDIENCE MEMBER**: Your scope of what you do, you said that discovery has already been there, but I am saying the charts is - that you discovered it farther, that you didn't include it in the warning areas and cleanup, and you have cleanup on the other side. So you are not giving us straight facts.

157. **MS. ARNOLD**: You say I am outside of it even though all the things, you know.

<u>USEPA Response to Comments #152 - 157:</u> The Aerojet facility is large and there are several groundwater plumes associated with on-site contamination. The proposed plan and public meeting on December 7, 2000 only dealt with the Western Groundwater Operable Unit (WGOU). The WGOU covers approximately 15 square miles; there are 5 square miles on Aerojet property and 10 square miles off of Aerojet property. Groundwater contamination to the north, east and south of Aerojet that is outside of the WGOU will be included in the perimeter groundwater operable unit (PGOU). On-site soil and groundwater contamination will also be addressed in separate OUs. The contamination found

on the northern side of the American River is being addressed through of the American River Abatement Order #96-230 issued by the Regional Water Quality Control Board September 24, 1996 which will be incorporated into the PGOU Record of Decision. Issues associated with the American River Abatement Order and the other future OUs will be addressed at future public meetings.

158. **MR. WAEGELL**: If the geology happens to be going north towards the river, the TCE would go towards the river. It would not flow in the direction with the aquifer because it is heavier than water. It goes by gravity. So if your clay layers go towards the river, that is where your TCE is going to go. Your aquifer may be going south, but that is irrelevant.

USEPA Response to Comment #158: This comment describes migration of TCE in the solvent phase or as a dense non-aqueous phase liquid (DNAPL). There is no DNAPL in the Western Groundwater Operable Unit.

159. **MR. LADD:** First point would be, I understand that the technology for perchlorate now is about 50 parts per trillion and the method, I can't say, is with the research council. My suggestion is consider what is most important, But the whole question it seems unlikely to me that this weight of perchlorate is due to what was dumped in 1956 through 1964, when the hydrology was very different, more diffuse. My presumption would be that there is a very low level phase of perchlorate further down, perhaps all the way to Watt Avenue where the groundwater converges.

USEPA Response to Comment #159: USEPA's Test Method 314 for perchlorate is the standard method used for perchlorate detection. Research laboratories may have developed lower detection limits but the test methods have not been peer reviewed. Also verification testing requires more than one laboratory with the capability. The present USEPA method is at the low end of the protective range. Extensive groundwater sampling has occurred to determine the extent of the Western Groundwater Operable Unit area plume. The Department of Health Services has not found perchlorate down-gradient of OU-3 which supporting the OU-3 boundary. The remedial action objective proposed for perchlorate is 4 ppb; groundwater contamination below that level will not require remediation.

REMEDIATION

160. **UNIDENTIFIED AUDIENCE MEMBER**: Who thought up this mess? You told us the same thing two years ago, that you were going to pump it out, and then they can't do - that did no good. Now we are back here again and you're telling us that you want to pump it. Again, you are not taking the contaminants in the ground. You are wasting money, time and power. This is some first-year engineering student idea.

161. **UNIDENTIFIED AUDIENCE MEMBER**: No. You were supposed to do some pumping and purifying the water. There you was going to pump it back into the ground. You still haven't taken care of the ground that - you are not going to do it this way. It is

not -none of us here is going to benefit from this. The only one that is going to benefit from this is Aerojet.

162. **UNIDENTIFIED AUDIENCE MEMBER**: I promise you nobody is going to wait 240 years for it to be cleaned up.

163. **MS. ARNOLD**: How about within 15 years? Why don't you make that the goal?

164. **MR. WAEGELL**: I sort of gather from the stuff I read, and I deal with Kiefer Landfill because we border on Kiefer, so I am a little familiar with pollution, that major pollution. I am sort of thinking that Aerojet is not going to succeed in cleaning this stuff up because what I read is if you stop your extraction well system the TCE level in the water comes up. It stays down as long as you pump. So, basically, we are to be pumping forever.

165. **UNIDENTIFIED AUDIENCE MEMBER**: People, we need to get together in one voice. I hear all of you and I know that you are here because you are concerned. We need to bind together. Individually we will hear exactly what we are hearing. It is not sufficient for me. I won't live 240 years. I'll bet none of you in this room is going to live 240 years. This is a bunch of bull.

USEPA Response to Comments #160 - 165: USEPA conducted model runs using the Remedial Investigation/Feasibility Study groundwater model provided by Aerojet to evaluate the time to achieve remedial action objectives, i.e., to clean up the groundwater. The model runs indicate that it would take 240 to 348 years to remediate the contamination in the Western Groundwater area for Alternative 4C or 4B. There are technical limitations on extracting, treating, and discharging the ground water. The aquifer can only support extraction of a limited amount of groundwater for remediation and discharge. The bulk of the contamination can be removed in a shorter time frame, but the last 10 to 12 percent of contamination is difficult to extract. In order to shorten the 240-year remediation timetable, new technology will need to be invented and applied to the site.

166. **UNIDENTIFIED AUDIENCE MEMBER**: Yeah. But you said that plume is going to be a certain place and you are going to stop it somewhere else, and it's already passed that area.

167. **UNIDENTIFIED AUDIENCE MEMBER**: You brought in all your own people to say what you wanted everybody to hear, and why watch the facts. All the boards up there show where the wells, little squares that have already been shut down, but in nowhere is it in the scope of cleaning and everything to the right of it is where you want to catch it before it goes anywhere.

USEPA Response to Comments #166 - 167: When the remedy is implemented, groundwater extraction wells will be placed at the leading edge of the plume in each layer. This will contain the plume.

168. **MR. BURKE**: Let's get together in 200 years and see how much has changed. Can you give me any indication of trichloroethylene sites that have been effectively remediated completely?

<u>USEPA Response to Comment #168:</u> Approximately 278 sites have been deleted from the National Priorities List, 17 of these sites that had trichloroethylene or another chlorinated solvent identified as a contaminant of concern in groundwater. These sites include:

DARLING HILL DUMP, Caledonia County, Vermont (Trichloroethylene)
TRANSITOR ELECTRONICS, INC., Bennington County, Vermont (Trichloroethylene)
DAVIS (GSR) LANDFILL, Providence County, Rhode Island (Vinyl Chloride)
MARATHON BATTERY CO., Putnam County, New York (Trichloroethylene)
UPPER DEERFIELD TOWNSHIP SANITARY LANDFILL, Cumberland County, New Jersey (Trichloroethylene, Vinyl Chloride)
SUFFERN VILLAGE WELL FIELD, Rockland County, New York (Trichloroethylene, Dichloroethane)
MIDDLETOWN AIR FIELD, Dauphin County, Pennsylvania (Trichloroethylene)
AMP, INC. (GLEN ROCK FACILITY), York County, Pennsylvania (Trichloroethane, Trichloroethylene)
CHEMICAL METALS INDUSTRIES (CMI), Baltimore Maryland (Tetrachloroethene, 1,1 Dichloroethane, Trichloroethylene)
NORTHWEST 58th STREET LANDFILL, Dade County, Florida (Vinyl Chloride)
AGATE LAKE SCRAP YARD, Cass County, Minnesota (Trichloroethylene)
NORTHERN ENGRAVING COMPANY, Monroe County, Wisconsin (1,1-Dichloroethylene, Trichloroethylene)
STEWCO, INC., Harrison County, Texas (Tetrachloroethene)
SAND SPRINGS PETROCHEMICAL COMPLEX, Tulsa County, Oklahoma (1,1,1-Trichloroethylene, 1,1-Dichloroethene)
29TH & MEAD GROUNDWATER CONTAMINATION, Sedgwick County, Kansas (Trichloroethylene, Vinyl Chloride, Carbon Tetrachloride)
SCHOFIELD BARRACKS, Oahu, Hawaii (Trichloroethylene)
HANFORD 1100-AREA (USDOE), Benton County, Washington (Trichloroethylene)

169. **MS. ARNOLD**: There was no size mentioned of how big the treatment plants were going to be. To me you're talking about a treatment plant it could be a ten-foot area open that you are cleaning. Why don't you take 10,000 of it and make a water purification plant out of it and clean it? How many years would you cut off of the 240 if you made a super large facility?

170. **MS. ARNOLD:** You guys never did answer me about a gigantic larger water purification plant, one that does not have to be dumped in the river to go like Bob Smith said, to get into our agriculture, first to eat and et cetera. Why don't you instead - and there has been in the newspaper about your wanting to sell off land to homes. Why don't you treat all your dirt and build a gigantic water treatment plant? You owe it to us.

USEPA Response to Comments #169 - 170: The size of the groundwater treatment plant is determined by the capacity necessary to treat the groundwater that can be extracted from the ground. The amount of groundwater that can be extracted is limited by the ability of the aquifer to continue to provide a sufficient quantity of water to be pumped out on a continuous basis and by the need to avoid drawing the level of groundwater down too rapidly. The volume of groundwater that can be extracted continuously without adversely impacting the aquifer determines both the size of the treatment plant and the cleanup time. The proposed remedy assessed what was technical supportable by the aquifer.

Contaminated soil in the source areas is part of a separate operable unit and will be cleaned up in the future.

171. **MS. ARNOLD**: Since I listened to your last one, I think we were told Arden-Cordova only had maybe three wells down, which are now up to seven. Apparently something is not working fast enough or good enough. Your facility is too small.

172. **MS. ARNOLD:** Also, if you do not clean up the dirt first, you are not going to clean - how are you going to solve the problem? You've already got a problem down in the water, but it is continually going down, but you say, "Oh, we will do it when we are required to do it by the EPA or whatever gets the fund. Why aren't you doing it immediately or, better yet, why haven't you done it?

USEPA Response to Comments #171 - 172: The first priority for the remediation of the Aerojet contamination is to safeguard the public's drinking water. Monitoring wells in the Western Groundwater Operable Unit provide data on contaminant movement. Groundwater extraction from the proposed extraction wells will help to contain and remediate the plume. It is USEPA's intention to remediate the soil after the immediate threat to the drinking water supply has been addressed.

173. **MS. ARNOLD**: It's obviously not enough to take - or you wouldn't be taking 240 years to clean everything up. Thank you.

174. **MR. KERSHAW**: Why is it getting drawn out?

175. **MR. KERSHAW**: I have heard all this. I have also heard that EPA would like this to go a lot faster, and I know that I would too. Something is holding this process up. It is very complicated, okay. Let's just go back to my house.

USEPA Response to Comments #173 - 175: Investigation of the extent of contamination, evaluation of the best technology to use in remediation, and the Proposed Plan and Record of Decision process takes time. USEPA and state agencies are moving as quickly as possible to contain the contamination and initiate remediation, and estimate that this remedy will be implemented in 2003. Once remediation begins, USEPA has estimated that it will take 240 years to

cleanup the groundwater under Alternative 4C. It is estimated that groundwater extraction and treatment will occur approximately two years after an enforcement agreement is in place. Also see the Response to Comments #160 - 165.

176. **MR. WAEGELL**: In the meantime you are taking all this water, It's undrinkable. Nobody wants to use it. It's going down the American River. And you are pumping water out of the aquifer. The aquifer is going down a foot and a half a year. We're planning to build all these houses around here, and where is the water going to come from?

177. **MR. WAEGELL:** This is Aerojet up here. The Douglas rocket plant is right here, and that is the picture I showed where you had the dry wells. The green area is 22,000 proposed houses that are going to go in. The purple area is Kiefer Landfill. Number three is Mather Field where they also put TCE in the ground. Number four is a major dump. What is in there I don't know. That is on Eagles Nest Road. And number five is - what is number five? The rendering plant. And number six is the Gerber dump. The little block spots right here are nine deep wells on our ranch. We have 2,700 acres in this area here.

And what is going on out in our area is Aerojet wants to build housing on some of its land. It has a contract with Folsom for, I don't know how many million gallons a day or whatever. But it does not have a contract with Folsom~ and it wants to use surface water to use that on its housing.

And in the meantime a few wells that have gone out of circulation in the four - in the area of number four, sort of And what is going on is they want to come down to our country, they want to come down to here, and they want to put in three wells, pump 6,000 gallons a minute, and pump it up Excelsior Road to Mather and clean it there, and then supply water to CostCo, the Sunrise corridor and Citizens Utility apparently who lost a well.

USEPA Response to Comments #176 - 177: Development is controlled through the local community zoning planning commission and not by the USEPA. Unless the Department of Health Services approves the direct discharge to the drinking water system of treated groundwater, new growth will have to be supplied from additional water supplies.

178. **MR. WAEGELL:** I don't believe in advanced technology. It was advanced technology that built this blooming dry well.

USEPA Response to Comment #178: Technology changes over time. Pilot studies are currently being evaluated by Aerojet. New technology offers the best hope to expedite the remediation time frame.

179. **MR. KERSHAW**: Are you in any way trying to stand in the way of this cleanup happening and speeding it up?

USEPA Response to Comment #179: The USEPA and state agencies are working to encourage Aerojet to implement containment and cleanup of groundwater contamination, as soon as possible.

180. **MS. WYANOSKY**: Once a plan is chosen, can Aerojet guarantee that the plume will not spread once the remedial thing is in place and they are starting to pump? Can there be come sort of guarantee that the plume will be contained?

USEPA Response to Comment #180: Aerojet will install three monitor wells for every two extraction wells. If the plume is not contained, there is a contingency provision to install additional extraction wells. The time line for additional extraction well installation is approximately 6 to 12 months after the detection of a health risk depending on weather conditions, e.g.,well and piping installation may be delayed or prevented during the wet season.

181. **MS. WYANOSKY**: And will Aerojet reimburse the area for the water they contaminated or just give it back and will that be placed in writing in the remediation process? Those are my comments to those issues.

182. **MS. KOSTLENIK**: And the other thing is I want to know legally how can I get reimbursed for the water that I am buying right now? Because I have heard lots of people say we don't - if you have cancer now it is really hard to tell if it was caused by the water you've been drinking for 30 years.

USEPA Response to Comments #181-182: Aerojet will replace the water from wells that are closed due to Aerojet contamination and Aerojet will continue to provide alternative water supplies as part of this remedy. The water provided by your water purveyor meets safety standards established by the Department of Health Services and is safe to drink.

183. **MS. BROWN:** If it is declared that this water is clean and safe enough to inject to the public drinking, where we do have kids playing in the river, fish are existing -

184. **MS. BROWN:** If it is going to be clean as you claim, it should be able to be used there for something or just to contain it.

USEPA Response to Comments #183-184: If the Department of Health Services determines that the treated groundwater is clean and safe enough for human consumption, it may be available directly to the water purveyors system for use as drinking water; otherwise, surface water discharge on-site will meet the substantive provisions of a National Pollution Discharge Elimination System (NPDES) Permit; off-site discharge will require an NPDES Permit. Any surface water discharge will be protective of human health and aquatic ecosystems.

185. **MS. BROWN**: I understand that. Why are you so opposed to keeping it on-site?

USEPA Response to Comment #185: The treated water will not be kept on site because the volume of treated water will quickly exceed the storage capacity of any lake that could be built. Also, see the Response to Comment #197. If the treated water were reinjected up-gradient, it would significantly increase the volume of water required to be extracted to control the contaminated plume.

186. **MS. BROWN**: Also, who is going to monitor this for the first hundred years?

187. **MS. BROWN:** Tests will be done where?

188. **MS. BROWN:** Will the water be tested at the point when it is going to be distributed into the river?

189. **MS. BROWN:** It is tested how frequently?

190. **MS. BROWN**: How much is being discharge to that site?

191. **UNIDENTIFIED AUDIENCE MEMBER**: Do they know when it is going to be tested? Is that scheduled testing?

USEPA Response to Comments #186-191: The monitoring wells, private water supply wells, and public drinking water wells, are currently sampled as part of the Partial Consent Decree on a monthly or quarterly basis. Additional monitoring wells will be installed as part of the remedy and groundwater sampling will be required as part of the remedy. The Central Valley Regional Water Quality Control Board or Department of Health Services may also initiate unannounced testing for public supply wells and will monitor compliance with water quality standards. If surface water discharge is selected, treated groundwater will be tested on a weekly basis. Two thousand to three thousand gallons a minute of treated groundwater are currently being discharged to the American River under state permit.

192. **MS. HEPLE**: But the point I want to make tonight in attending the hearings on the ongoing RCRA covered operations and the phasing out of the RCRA operations, which is what the gentleman had been referring to early tonight. He had been to a meeting on the phasing out of plans under RCRA Department of Toxic Substance Control, that at that time in the public record I requested that efforts be made to dovetail looking at the cleanup of the RCRA areas and dovetail that with the Superfund cleanup. At that time I was told there wasn't a lot going on. They talked about it, There were some ideas, and I made a point of having it in public record. I wanted to be in the public record tonight. I want to hear more in the future about the degree to which these, everything is not being compartmentalized, the ongoing operations and the phasing out of those operations are being looked at in conjunction with the cleanup.

USEPA Response to Comment #192: Current Aerojet operations fall under RCRA. RCRA facilities may be closed under RCRA regulation and may not

required any further action. If there is contamination that qualifies under both RCRA and CERCLA, the remediation of this contamination may be referred to the CERCLA program.

193. **MS. HEPLE**: And as you know, the whole site is incredibly complex. We have been talking about one particular area tonight. But it does move out of the area with some of the major operations and contamination.

USEPA Response to Comment #193: Source areas will be addressed in a future operable unit.

194. **UNIDENTIFIED AUDIENCE MEMBER**: How far down, to what minimum level can you test? I heard that machine to test for perchlorate is very rare and hard to come by.

195. **UNIDENTIFIED AUDIENCE MEMBER**: Aerojet has it. Does EPA have it?

196. **UNIDENTIFIED AUDIENCE MEMBER:** Does anyone test for one part per billion?

USEPA Response to Comments #194-196: There are many labs that test for perchlorate including one in Rancho Cordova using USEPA Test Method 314 for perchlorate. The standard reporting level is four parts per billion. One part per billion figure is a typical detection level; it is necessary to be able to detect perchlorate at a level that is below 4 ppb in order to be able to accurately report the concentration of perchlorate at 4 ppb.

197. **MR. LADD:** The next question is, knowing that water is one of the greatest - water in California is one of the greatest zero gains there is, and it is probably not within the realm of this operation to decide. When you get that 10,000 gallons per minute, what does that equal in terms of acre-feet and credits on the American River and the ultimate political question of who gets what.

USEPA Response to Comment #197: Approximately 51 acre ft per day or 18,630 acre ft per year of treated water will be produced. State law will determine who will own the new water created by extracting and treating the groundwater.

COST

198. **MR. BURKE:** It so happens you picked the cheapest alternative. It so happens you picked an alternative that is, in my view, way out of the ballpark for the cost of this cleanup, and it so happens that Aerojet is still maintaining profitability. I just have one question for Aerojet.

199. **MR. BURKE**: I would like you to know one of those sites where there is still ongoing cleanup and trichloroethylene is heavily contaminated, a place on the East Coast called Aberdeen Proving Grounds. In that case the Army is spending $100,000,000 a year,

100,000,000 a year, not in 30 years, one year, 100,000,000 a year to cleanup trichloroethylene.

200. **MR. BURKE**: I would expect a similar scale effort on the part of Aerojet. It is appalling to me - I am going to tell you something, this will not stand, the 240-year time frame. There are many more different advantages to increasing the numbers of wells and doing other kinds of technologies. I don't believe, and I am sure it runs in the millions of dollars that Aerojet has spent for its consultants to do this kind of work. I just don't believe that they've been paid for this job, I'd just like one more question. On the balancing criteria you indicated that cost was equal to all the others. So that means that if a particular strategy or a particular cleanup scenario is analogous in other ways, if it cost more it could well have been rejected; is that correct?

USEPA Response to Comments #198 - 200: At Aberdeen Proving Grounds, the first operable unit in 1991 addressed contaminated groundwater. The present value cost of the remedy was estimated to be $9.12 million to treat contaminated groundwater; the estimated annual operations and maintenance costs are less than $467,000 for 30 years.

The USEPA's preferred Alternative 4C is the least expensive for the life of the project, but the most expensive for the first 30 years of the project when compared to Aerojet's preferred Alternative 4B. The 30 year present value cost for Alternative 4C ranges from $109.1 M to $111 M dollars. The Department of Defense reimburses Aerojet for approximately 88% of their allowable environmental remediation costs through their forward pricing rates.

201. **MR. STRATTON**: My question is, our water rates have been going up. Is there any provision for us being reimbursed for that? We understand they have to shut down wells and use more expensive water.

USEPA Response to Comment #201: There is no provision for reimbursement to homeowners for increased water rates; these rates are determined by the water purveyors. Provision of alternate water supplies to replace wells shutdown due to Aerojet contamination is presently covered by the Partial Consent Decree (PCD) with Aerojet under Exhibit IV "Interim Protection of Drinking Water Supply Wells". The Western Groundwater Operable Unit ROD (OU-3) alternative water supply replacement provisions will supercede the portion of the PCD covered OU-3.

202. **MS. ARNOLD**: So far you have spent all this money gathering data and paying people for research, and you really haven't done that much for us, because if you have it wouldn't be in my area and you haven't included in the map the well that is contaminated in my area. You say I am outside of it even though all the things, you know.

USEPA Response to Comment #202: Ms. Arnold lives near Arden Cordova Water Company (ACWC) Well #14 and works near ACWC Well #15; these wells

are within the operable unit and correctly shown to be within the area of remediation. Under the present Partial Consent Decree, a Final Water Supply Alternative Report was submitted by Aerojet for ACWC Well #15 on June 19,2000 and was approved by the USEPA and State on July 12, 2000. ACWC Well #14 has been removed from service and there is a dispute between Aerojet and Southern California Water Company (SCWC owns ACWC) as to the appropriateness of the actions taken by SCWC and Aerojet's cost responsibility for such actions.

203. **MR. WILLIAMS**: During that period that I left Aerojet, from 1987 through - all the way up until 1997, 1 would get periodic visits from your insurers because I had come forward and said enough. And what they told me at every step of the way was that to clean up the Lower American River Valley was going to cost $300,000,000 in 1987.

204. **MR. WILLIAMS**: Does this money come from Aerojet or does it come from the Superfund?

The Superfund kicks in nothing?

205. **MS. WYANOSKY**: So it is in writing. Will they put in writing to reimburse the area for the water being contaminated? Will they give it back to us?

Is it free to the city or is Rancho Cordova paying for it?

USEPA Response to Comments #203 - 205: The Lower American River Valley cleanup, which is assumed to mean the complete cleanup of the Aerojet site, will require much more effort than the Western Groundwater OU. OU-3 is estimated to cost $111 million in 30 year present value dollars. The USEPA does not have an estimate for the complete cleanup of the Aerojet Superfund Site. GenCorp and Aerojet have been reimbursing USEPA for its oversight costs pursuant to the Partial Consent Decree. The Department of Defense has been reimbursing Aerojet for 88% of allowable environmental costs pursuant to an agreement between the Department of Defense and Aerojet. One of the Remedial Action Objectives (RAO) for OU-3 is the restoration of groundwater aquifer. It is anticipated that the enforcement agreement for OU-3 will include this provision.

206. **MR. BURKE:** I have a follow-up to several questions here. If during the 240 years the cleanup is going to go on or whatever period of time, if Aerojet were to go out of business, what would happen? Who would pay for the cleanup? What would be the legal options of EPA? Happens all the time.

USEPA Response to Comment #206: If Aerojet goes out of business, USEPA could seek recovery from Aerojet's parent company, GenCorp. Indeed, USEPA and the state sued both Aerojet and GenCorp in 1986 and both companies signed the 1989 Partial Consent Decree under which Aerojet is performing the RI/FS at the Site. In the event that the governments are unable to prevail

against Aerojet and GenCorp or neither Aerojet nor GenCorp has funds available, USEPA and the state agencies would use public monies to pay for cleanup.

CREDIBILITY

207. **UNIDENTIFIED AUDIENCE MEMBER**: I agree with the people here. And I am the chairperson for the Concerned Citizens of the Rancho Cordova Water System, and we need to know the truth. Your credibility is -- we doubt it. We appreciate you getting the meeting together. We appreciate you giving us information. We don't appreciate being lied to. We don't want to snow anything over. We want to know the facts. We have a problem with our water, and these people here are concerned and I am concerned. And it has already gone to a full-blown proportion that we have a problem. And we don't want it sugar coated.

208. **MR. KERSHAW**: You've spoken very smoothly and convincingly, but so do the Firestone spokes people and so do people who told us tobacco doesn't give us cancer for a decade and they knew better. I am not accusing you of lying, but I don't see any reason to believe you. Just because spokespeople like you - you have lost your credibility.

USEPA Response to Comments #207 – 208: The Remedial Investigation/Feasibility Study has shown that contamination from Aerojet has contaminated the aquifer. The remedies presented are reasonable considering today's technologies. USEPA and the state are committed to keeping the public informed and this will be done through fact sheets and public meetings.

209. **UNIDENTIFIED AUDIENCE MEMBER**: Well, they are going to keep putting it in the ground.

USEPA Response to Comment #209: In the past, Aerojet injected treated water into the ground but USEPA's preferred alternative, Alternative 4C for the Western Groundwater area does not include reinjection. Treated groundwater will be discharged to surface water, or will be available for direct discharge to the drinking water system, if approved by the Department of Health Services.

210. **MR. BURKE:** You know and I know that trichloroethylene has a unique property of bonding to the interstitial porosity of sedimentary rocks, and groundwater is a highly fluctuating, dynamic system, and to simplify things as you have in this diagram here, which almost any elementary geologist would be appalled by this graph that you have of this cross-section of the stratigraphy in this area is absurd, and I am appalled that you would depict and the engineers here on this panel would simplify the geologic conditions of the site with all these question marks I note is virtually meaningless.

211. **MR. BURKE**: Maybe you should get geologists to do your charts.

USEPA Response to Comments #210 – 211: In the Western Groundwater Operable Unit, trichloroethylene is not present as a pure phase liquid, but is only present dissolved in water. The geologic map and data presented were developed with the layperson in mind, and were simplified. The more complex and detailed geologic maps are contained in the Remedial Investigation/Feasibility Study.

212. **MR. WILLIAMS:** Well, you were sued in court by the State of California and by the federal government for just what you are saying that you have not done, and you negotiated a settlement, which means that there is no conviction but does not mean that there was no crime.

213. **MR. KERSHAW**: Please just speak straight. If she would say we screwed up and we poisoned the water, and now because of legalities and federal government and state government we have to clean it up, I'd believe that.

214. **MR KERSHAW**: That is all you can say because of legal restrictions regarding litigation that is going on because Aerojet won't take responsibility for what they've done and are trying to dray it out and save money. Is that why? I am sorry. I thought maybe it was. I don't feel like I'm getting a straight answer.

215. **MR. KERSHAW**: I don't believe you when you say that.

USEPA Response to Comments #212 – 215: Aerojet and the regulatory agencies are working to improve lines of communication to address the community's concerns.

216. **UNIDENTIFIED AUDIENCE MEMBER**: You check samples they give you?

USEPA Response to Comment #216: The Regional Water Quality Control Board (RWQCB) periodically collects split samples (each sample taken is subdivided between Aerojet and the (RWQCB) to allow for each test for contaminants). Samples from water supply wells are collected with and without prior announcement or arrangement. These samples are sent to a state or independent laboratory for analysis.

217. **MS. HEPLE**: There wasn't - there never was public focus on cleanup.

218. **MS. HEPLE**: And as someone who has follow this for 22 years now, I tried to get my daughter to come tonight. She was six months old when it came out in the newspaper that it was Aerojet's pollution. At first Aerojet said, "No, that TCE couldn't possibly be ours." But when the perchlorate was discovered, I don't know how, given the detection methods in late '78 they were able to figure it out. But that was in the Sacramento Bee. I called Stan Philipee at the State Water Board at that time. The discovery of perchlorate was very early, but yet we, all of us and many of the same people are still involved over the years, ignored perchlorate all through the '80s and '90s. Very, very sad. And it's - I am a lot more

cynical than I was back then, and it is hard to listen to some of the positive spin on things because I heard it and visited Aerojet and saw the systems and now I realize how inadequate a lot of what was going on was.

219. **MS. KOSTLENIK**: A basic human tenet is that a conflict of interest and that if this little divide here, you guys expect or are surprised by our anger, that you are naive. We are people. Also, we expect that you are going to put a positive spin for the people who pay your bills, they give you money. That would be unreasonable on my part to think that the place that you work for you are, of course, put a positive spin on it.

220. **MS. KOSTLENIK:** So don't take it personally when I am over here chuckling at you. Of course, you are going to put a spin on it. So, anyway, I think that is where I feel it is reasonable for me to be upset and angry and it is reasonable that you are going to put a positive spin on it. At the same time all through history it doesn't take a rocket scientist to figure out that, pun intended, that you know the example of the tobacco industry. And it is really easy to point our fingers at them. And I know the intentions are good and that - I believe that you didn't know that perchlorate was not harmful. Now that you know it is I need to know how I can get my tap water tested. I don't want to call on these people that are running around. I need to know what kind of bottle I put it in from you EPA people and Shelley. I want to know tonight. I want to know tomorrow how I can get up at 5:00 in the morning and get my act together and figure out what is in my tap water.

USEPA Response to Comments #217 - 220: See Response to Comments #207-208. The California Department of Health Services and the Regional Water Quality Control board can provide information regarding how to sample tap water.

221. **MR. WILLIAMS:** The reason that there is no data for that is because it has been suppressed by corporations like Aerojet and Aerojet itself. So that any deaths and/or settlements that were done would remain sealed and people not able to speak about them.

USEPA Response to Comment #221: Health studies done by the Department of Health Services are part of the public record and are included in the administrative record. The current perchlorate studies must undergo peer review before they will be released to the public.

GROUNDWATER/SURFACE WATER CONTAMINATION

222. **MR. SMITH**: I worked in the construction field for Bechtel Corporation for 19 years. You're talking about pumping this water out and everything. What's going to happen if a farmer gets in and starts pumping water on his land?

USEPA Response to Comment #222: The Western Groundwater Operable Unit is in a developed urban area where well installations require a state permit. Use of untreated contaminated groundwater for farming has an unknown risk.

Studies are currently being conducted to determine if perchlorate accumulates in agricultural crops.

223. **MR. SMITH**: You're bringing it to the surface. You guys are bringing it to the surface when you are taking it and dumping it in the creek. You're still bringing it up there. I can't see where you are going to accomplish anything.

USEPA Response to Comment #223: The groundwater that is extracted will be treated before it is discharged either directly to a drinking water system or to surface water. As groundwater is extracted from the aquifer, it will be replaced by clean water from outside the operable unit, which will flush residual contamination out of the pore spaces (the spaces around the soil particles). The USEPA estimates that after flushing groundwater through the operable unit six times, using the pump and treat system, the aquifer will be cleaned up. Over time, this process will clean up the aquifer.

224. **MR. SMITH**: What are you going to do to Aerojet, stopping them from putting more contaminants in the ground?

USEPA Response to Comment #224: Aerojet is required under California and Federal law to control all chemicals used at the facility so that additional soil and groundwater contamination does not occur.

225. **UNIDENTIFIED AUDIENCE MEMBER**: In the rainy season couldn't you get a perching effect again?

226. **MS. ARNOLD:** Isn't it coming from the dirt? Where did the groundwater get it from, the dirt?

227. **MS. ARNOLD**: Isn't it spread out over the dirt and that heavy rains stepped it all down into our different pools that you missed out and the injection helps spread it farther?

228. **MS. ARNOLD**: But you are only doing the top layer. You are not worried about the bottom layers and you are not getting ahead of the other layers. I heard this one before since '73.

USEPA Response to Comments #225 - 228: Source area remediation will be addressed in a future operable units. Water that percolates down through contaminated soil will be captured by the inner, on-property ring of extraction wells. This will stop contaminated groundwater from traveling beyond the western boundary of Aerojet. Groundwater will be extracted from Layers C, D and E; the first two (upper) layers only have lenses or limited areas with groundwater.

229. **MR. WAEGELL**: I am a farmer. I lived in the same house on Eagles Nest Road for 74 years. I am part of the scenery around here. Aerojet injected water in dry wells when they

were building rockets. How many sites did they have on Aerojet property where they dug these dry wells you see behind you?

How many of these dry wells, similar installations, were on Aerojet property or dug underneath your property?

USEPA Response to Comment #229: The "dry wells" referenced in this comment may be the unlined ponds and pits that Aerojet used to dispose of water and TCE. There are over 300 source areas which have been identified in the Aerojet Remedial Investigation/Feasibility Study (RI/FS), a large portion of which are unlined ponds and pits. While the RI/FS for the overall site is not fully complete, the USEPA believes that the majority of the source areas have been identified.

230. **MR. WAEGELL**: There are 300 source areas where they pooled TCE or put it down in the aquifer. This site here, they injected it into the ground as you see on the right. That did not carry it, so they built a 60 by 60 by 5-foot high reservoir. When that did not carry it, then they put it out in the reservoir and let it evaporate or go into the ground that way. This is on Douglas Road near Grant Line where the big tall white building is.

They want to build 22,000 houses right across the fence from this installation. How many gallons of TCE did Aerojet use in manufacturing its rockets over that period and injecting into the ground? This should be known.

231. **UNIDENTIFIED AUDIENCE MEMBER**: I could tell you. My neighbor is a retired Aerojet person. He tells met it was at times 88 barrels a day.

232. **MR. WAEGELL**: If you know how many gallons of stuff you put it and you know when you are cleaning it, you know how many gallons you take out with your stripping system, and that should be known so you get an idea of what percentage of the stuff you are picking up, because TCE is heavier than water. It's a dense nonaqueous phased liquid. It doesn't go - the direction of the aquifer flow is toward Elk Grove, towards the constant depression in Elk Grove.

USEPA Response to Comments #230 - 232: The exact number of gallons that were discharged into the groundwater is not known. The amount of Trichloroethylene (TCE) removed will not equate directly to the volume disposed by Aerojet because some TCE would have volatilized during disposal and some natural attenuation occurs in the groundwater. Aerojet has investigated the location and extent of the plume associated with these comments and has gone on record at the December 7, 2000 public meeting that they are committed to removing and treating the contaminated groundwater. The specific area in question will be covered partially under this operable unit and the remainder under a Regional Water Quality Control Board Order #97-093 issued July 1, 1997.

233. **UNIDENTIFIED AUDIENCE MEMBER**: While he is going that, I want to know that there was straight dumping, no filters, since 1985, 70 to 1985, massive.

234. **UNIDENTIFIED AUDIENCE MEMBER**: You did not do anything to our water but pollute it in 1985. Since 1985, you've been doing that.

235. **UNIDENTIFIED AUDIENCE MEMBER**: Any kind of treatment of the water, just not dumping all of the pollution right into the ground. There was no precautionary measure whatsoever that you took for any of us. You didn't even have a liner; you had nothing. You filtered nothing. And you have dumped it straight into the ground, which is the reason that we are having the problem. We own property here. What are we going to do with the property when nobody wants to pay and buy our homes because they can't drink the water? Who is going to compensate us for that?

USEPA Response to Comments #233 - 235: As stated by Aerojet in the December 07, 2000 public meeting, Aerojet operated under practices and procedures in common use at the time the wastes were disposed. Aerojet recognizes that their past practices resulted in soil and groundwater contamination. Aerojet is has been performing the Remedial Investigation/Feasibility Study under the partial consent decree. There are five groundwater extraction systems currently operating, one of which is in the Western Groundwater Operable Unit (WGOU). The implementation of the WGOU will be another step in the cleanup process.

236. **UNIDENTIFIED AUDIENCE MEMBER**: When you go to sell your property, when you have babies, they can't drink the water. They just can't. It is worse in some areas than it is in the others.

USEPA Response to Comment #236: Aerojet is working to clean up the contaminated groundwater. The water supplied by water purveyors is monitored closely by the Department of Health Services to ensure that it is safe.

237. **MR. WILLIAMS**: I worked for Aerojet as an associate chemist, laboratory specialist in the analytical chemistry department for 13 years, from 1975 through 1987.

First of all, I would like to ask: Rosemary, were you around when Cordova chemical Company was in operation?

We see that Aerojet does have a company that was in existence and now is not in existence, and they caused a good portion of some of this pollution nightmare that we have on our hands. And they are not even in the picture.

USEPA Response to Comment #237: Aerojet is responsible for any contamination that was created by the operation of Cordova Chemical.

238. **MR. WILLIAMS**: So the law is still on the side of us who are concerned about our health, for ourselves and our children. I want to ask first EPA: Are you aware of any other chemicals that Aerojet has manufactured and has on their site in this pollution that is not shown in this equation, and that are toxic and/or carcinogenic and other problems? One of the reasons it that they don't happen to appear on EPA's toxics list.

239. **MR. WILLIAMS**: You've tested for everything that Aerojet manufactured?

240. **UNIDENTIFIED AUDIENCE MEMBER**: What percent of the chemicals is that?

241. **UNIDENTIFIED AUDIENCE MEMBER**: The fact of the matter is that less than one percent of the chemicals in our society can be tested and described. You are saying you tested everything that could be tested for. The fact is that is probably less than ten percent or five percent of the chemicals used.

242. **MR. WILLIAMS:** You can develop tests for those specific chemicals. I know you did not have to do that. All you had to do was go out on a sunny day and watch the ground bloom with ammonium perchlorate crystals.

USEPA Response to Comments #238 - 242: From 1991 through 1993, Aerojet investigated more than 270 potential source areas within 18 management areas at the locations with the greatest potential for higher concentrations of chemicals and, therefore, the highest probability of identifying the chemicals of concern. Areas were characterized by the use of two different suites of laboratory analyses: the Standard Analytical Suite and the Comprehensive Analytical Suite.

Aerojet used the standard Analytical Suite for all wells selected for sampling. It included halogenated volatile organic compounds (EPA Method 8010), nitrate and nitrite (EPA Method 300), perchlorate (EDL Method EA-005), NDMA (EPA Method 8070) and pH, conductivity and temperature as field measurements.

The Comprehensive Analytical Suite was used for samples collected from wells hydraulically downgradient of source areas, in peripheral areas and on the western property boundary, and in the areas of varied potential chemical usage. Additional wells were selected at the perimeter in deeper units to assess groundwater leaving the site in the primary water-bearing zones. The Comprehensive Analytical Suite targeted the shallowest groundwater with the highest probability of detecting chemicals of potential concern. The Comprehensive Analytical Suite included all of the Standard Analytical Suite compounds, with the following additions: aromatic and halogenated volatile organic compounds (EPA Method 8240), chloride, sulfate, phosphate (EPA Method 300,0), semi-volatile organic compounds (EPA Method 8270), metals including hexavalent chromium (EPA Method 6010), total petroleum hydrocarbons, diesel or kerosene (EPA modified 8015), chemical oxygen demand (EPA Method 410) and biochemical oxygen demand (EPA Method 405.1).

The USEPA and State Agencies are working with Aerojet to review each year any new analytical methods for chemicals used or manufactured at Aerojet. Analytical methods do not exist for all the chemicals manufactured or used at Aerojet which is why suite of chemical tests have been used. When an unidentified chemical has been detected in the screening process, a further review has been initiated to determine the unknown chemical. Current testing has not found unknown chemical which need to be identified.

243. **MR. WILLIAMS**: In all due respect, Aerojet did have containment wells. However, these containment wells were made of cement, and as we know cement is porous. And so those things, those chemicals that were put in those wells that we though were evaporating and then they would be hauled away in sludge bind were actually going into the aquifers. And that is now some of this stuff happened.

And that's in addition to the things that you said in '79 nothing happened. You weren't there in '79. You don't know. And I guess you probably didn't know all the way up until '84. 1 was one of the people who went to OSHA and was a whistler-blower on the contamination that was going on for the dumping of the chemicals and the non-containment.

USEPA Response to Comment #243: Aerojet used practices that were commonly accepted and approved by industry and the government at the time of disposal. As new and improved disposal practices have been developed, they have been implemented by Aerojet.

244. **MR. LADD**: In the interest of not delaying that cleanup any further, I will be very brief, ... for clarification. The four parts per billion perchlorate is for the entire well water, not individual aquifer within that well? It is four parts per billion in the entire sum of the water?

USEPA Response to Comment #244: The four parts per billion is the proposed remediation standard that applies to the aquifer.

245. **MR. ROSCOE:** I think I heard that before 1997 you didn't know there was perchlorate in the drinking water or in your water that you were injecting? How about your injection wells?

USEPA Response to Comment #245: In 1985, Aerojet knew water that contained perchlorate was being injected into the aquifer but perchlorate was not known to be a health threat. In 1992, the USEPA performed the first toxicological review for perchlorate and determined that it was a health threat; however, it was not detectable off-property using test methods available at that time. In 1997 the state improved the detection capability for perchlorate from 400 ppb to 4 ppb and perchlorate was detected off-property.

246. **MR. DUMONT**: How much noise does this 7,000-gallon per minute pump make? I worked at Mather when we used to pump 8,000 gallons a minute. You could hear them more than a quarter of a mile away when you started, and they made a howl all the time they were running.

USEPA Response to Comment #246: The 7,000 gpm rate will come from a series of wells; individual wells are anticipated to operate in the 150 to 500 gpm range. This will minimize the noise. Also, Aerojet can select different types of pumps, such as submersible pumps to minimize any noise impacts in residential areas. The pumps installed in the local Sailor Bar Park under the American River Regional Water Quality Control Board order would be representative.

247. **MS. BROWN**: I am concerned about the recontaination of the water sources if you want to reinject the water into and a long-term effect of that.

248. **MS. BROWN:** But how do we know that there may not be more chemicals found in 15 years as we did the chemicals today? Why not just keep it contained, the contaminant, instead of sending them downstream? So out of sight, out of mind.

USEPA Response to Comments #247 - 248: In Alternatives 4C and 4B, groundwater will not be reinjected after it has been remediated. The decontaminated water cannot be kept on site because the volume generated would be to great to store. See the responses to comments #185 and #197.

249. **MS. LUNCEFORD**: I was just wondering if there are any plans for groundwater recharge with any of these alternatives? What are we going to do about DFS, has anything been said about their supply for the Lincoln Village Rosemont area that depends on groundwater? There you are. Have you said something?

250. **MS. LUNCEFORD**: We are not concerned about groundwater supply, then?

USEPA Response to Comments #249 - 250: The preferred alternative does not include recharge. USEPA and Aerojet recognize that there will be an impact on the groundwater table in every alternative. Groundwater must be extracted to achieve containment of the contaminant plumes and to achieve groundwater cleanup. One of the options for remediated groundwater is surface water discharge.

251. **MS. LUNCEFORD**: Obviously, I would like to talk about what is most important right now. In the back of your mind you should consider the possibility of using that lower technology as it gets more efficient to finally define where this entire realm of groundwater that originated from Aerojet is from, not because I am worried about one part per billion perchlorate. But the possibility that there might be other substances dumped early on in the Aerojet operation. I want to put that in the record.

USEPA Response to Comment #251: Aerojet has investigated the contamination in groundwater in the Western Groundwater Operable Unit. Also see the Response to Comments #159 regarding detection method and #238-242 regarding the requirements for Aerojet to search for additional analytical methods to analyze for more of the chemicals and chemical byproducts that were used or produced by Aerojet.

252. **MR. WHITE**: How is the 7,000 gallons per minute arrived at? Is that flow rate that is coming down the gradient or something else?

USEPA Response to Comment #252: The wells that will be installed will pump at rates ranging from 150 gallons per minute to 500 gallons per minute for a total of about 7,000 gallons a minute. The pumping rates have been selected to balance the need to extract and clean up groundwater with the need to minimize impact on the aquifer.

REPORTS

253. **MS DOVE**: Those reports are public record?

USEPA Response to Comment #253: All of the reports dealing with the Western Groundwater Operable unit are public record; there is a public repository at the Cal State University Sacramento Library.

254. **MR. ROSCOE**: My name is Rob Roscoe. I have a simple question. Are the transcripts going to be made available to the public?

255. **MR. ROSCOE:** I am wondering if I can get a copy on the Internet or something before the public comment period ends, so we can see what was said here tonight as we prepare written comments.

USEPA Response to Comments #254 - 255: The transcript of the meeting was made available via email before the comment period closed and will be part of the site web page.

256. **MR. BURKE:** This was a study only of perchlorate?

257. **MR. BURKE:** None of the other contaminants including trichloroethylene which we know is a very common carcinogen.

USEPA Response to Comments #256 - 257: In the 1997 and 1998, the California Department of Health Services (DHS) collected health statistics from the surrounding communities for analysis. Some of these communities, like Fair Oaks, did not have perchlorate in their water supply. Researchers examined the national statistics, and there were no statistical differences in any category. The

DHS has studied the reproductive and developmental effects that involved the effects of contaminants on the thyroid and is involved in long-term studies of perchlorate. DHS is in the process of conducting long-term cancer studies.

USEPA is not able to currently state that perchlorate doesn't cause cancer. The USEPA classifies perchlorate as a B2 carcinogen based on animal studies, specific to the thyroid. A B2 carcinogen is a probable human carcinogen (sufficient evidence in animals and inadequate or no evidence in humans).

FUTURE SITE

258. **MS. DOVE:** My last question is, I have heard some discussion about municipalities such as Rancho Cordova, which is not actually incorporated, but the city of Folsom which is, that they're interested in annexing this property and having some future control. My question is: The ownership of Aerojet, what is to protect the public in the future, in this 200 years, from Aerojet deciding to close out their cleanup and leave it to the greater community? This is a two-parter. And the other question is: What is to protect us, that is the citizens, from Aerojet selling off some of their land that they've claimed to have cleanup up for future development?

USEPA Response to Comment #258: See Response to 206. Aerojet is legally obligated to continue their efforts to cleanup the site. In a settlement agreement between the Department of Defense (DoD) and Aerojet, DoD pays up to 88% of Aerojet's environmental remediation costs and the remaining 12% is payed by Aerojet. Should Aerojet lack the financial resources in the future to complete site remediation, the USEPA will pursue its parent company, GenCorp. If necessary, USEPA and the state would complete the cleanup. As a matter of National Policy, USEPA encourages the return of Superfund land that has been remediated to productive use.

259. **UNIDENTIFIED AUDIENCE MEMBER**: There will be delisting?

260. **UNIDENTIFIED AUDIENCE MEMBER**: You have a site and you take part of it and say it is no longer a Superfund site, please explain to me why that is not delisting that ground.

261. **MS. DOVE**: You didn't exactly answer, but perhaps I can read between the lines. Is there a current plan at Aerojet if you can decertify or take these particular lands out and pronounce them now clean to see those lands or turn them over in some fashion for development?

262. **MS. BROWN**: You want to build all those homes, something. I'm a little bit concerned.

USEPA Response to Comments #259 - 262: The Western Groundwater Operable Unit does not address removal of land from the USEPA National

Priorities List. This clarification of what is part of the Aerojet Superfund Site will be addressed in the future in a modification to the existing partial consent decree. Generally, when a site is listed on the USEPA's National Priorities List, the listing is done from fence line to fence line, i.e., based on property boundaries. However, depending on the results of investigation of the site, the boundary of what is designated as a Superfund Site can be smaller or larger. Ultimately, Superfund defines a site to be where contaminants have come to be located.

AEROJET PROPERTY

263. **MS. ARNOLD:** First I would like clarification. How much acreage is Aerojet? How large is Aerojet?

USEPA Response to Comment #263: Aerojet is about 20 square miles or 13,000 acres.

HEALTH CONCERNS

264. **MS. ARNOLD:** You said the human interest, and I noticed in the brochure you were only concerned about cancer. Now water contributes to other things like your arteries and bringing nourishment to different parts of your body and your brain waves and et cetera. I haven't heard anything. I just heard cancer.

265. **MS. ARNOLD**: What about the other issues? Maybe I am a little dingy from drinking your water all these years. I am definitely preaging faster than I should be.

266. **MS. ARNOLD:** That is why people are dying around me.

267. **MS. ARNOLD:** Are they looking at different things? They haven't been looking in the past.

268. **MR. WAEGELL:** Nobody seems to want it. I wouldn't bathe in it. I certainly wouldn't bathe my child in it.

USEPA Response to Comments #264 - 268: The wells that have been tested and determined to exceed California Department of Health Services (DHS) action levels have been shut down. The drinking water being provided today meets DHS requirements. Past potential impacts are being evaluated by the DHS. USEPA's perchlorate research data on perchlorate toxicity should be available in the third or fourth quarter of calendar year 2001.

269. **MR. WAEGELL:** Would you drink the water you discharge?

270. **UNIDENTIFIED AUDIENCE MEMBER**: You said you would drink it, but nobody, in fact, does drink it.

USEPA Response to Comments #269 - 270: The groundwater that is being extracted is treated with ultraviolet oxidation for N-Nitrosodimethylamine (NDMA) destruction, biological treatment for perchlorate destruction, and air stripping for remaining Volatile Organic Compounds (VOCs) removal. Although the specific treatment process for perchlorate and NDMA have not yet been approved by the Department of Health Services for drinking purposes, sampling results indicate that the treated water is cleaner than the water Aerojet would extract and treat from the American River or from the Folsom South Canal.

271. **MS. SHARP**: I do not live in Rancho Cordova although my grandmother lives in Fair Oaks. I actually work for a national environmental advocacy and research group called the Environmental Working Group. I am here to make a very specific comment slash question, and that is the four part per billion level for perchlorate is not low enough for this reason: Even though it is the low end of the action level that California has set, if you look at how they determine that level, will see that they use as their assumption a 70 kilogram adult weight, drinking two liters of water per day. And 40 percent of the infants in this country are bottle fed, and they drink seven times the amount of water relative to their body weight. Not only that, but they also are the most sensitive part of the population. They are the ones most likely to be impacted by description of thyroid hormone levels when their brain is bring to be developed. If you look at that, four parts per billion is not low enough. And also I know that the state is only certified to detect perchlorate to four parts per billion. If you look at the recent literature, they can actually detect perchlorate to less than one part per billion on the order of 0.3 parts per billion.

So my question is: How are you going to explain to the children of Rancho Cordova why they were not taken into consideration when you developed your cleanup levels?

272. **MS. SHARP**: I am going to make this real short. I have a Master's degree in biology and my father is a neurologist. I am very aware of the impacts on thyroid hormones. And when you're talking about developing children, you know, we are talking about - the very definition of hormone is that is works at very, very small levels. And a disruption of any tiny amount could have profound effects.

273. **MS. SHARP**: I am saying right now that the data you have, the California Department of Health Services said the action of 4 to 18, they based on a 70 kilogram adult, and that is wrong. You need to base it on developing children. That is all.

274. **MS. KOSTLENIK**: The other thing is, gentleman, Charles Berrey, you were saying that - I think you said if you knew that you could - about adjusting the base levels for children, which is currently not, and that you - I think you made an allusion to somebody is trying to get that information in there for you guys to change your base level. What needs to be done to get you guys to consider the base level for children?

USEPA Response to Comments #271 - 274: There are a number of studies that support a perchlorate action level of 4 to 18 ppb. Additional perchlorate studies have been conducted and are currently under review. Children who drink formula may have a greater exposure, approximately 7 times higher than for adults. The USEPA's pending toxicological evaluation of perchlorate will take into consideration the effects of perchlorate on children. Action or cleanup levels will be adjusted, as new data is available.

275. **MR. BURKE**: You indicated something about some studies taking place regarding disease-related impacts of the contamination? Did I misunderstand?

USEPA Response to Comment #275: There are many studies that are being conducted around the world concerning the impact of perchlorate on human health. The Department of Defense and the Perchlorate Study Group of which Aerojet is a member have financed toxicological studies on perchlorate which are being submitted to the USEPA for evaluation. It is anticipated that the toxicological data will be available to the public in the third or fourth quarters of 2001, when it is made available to external peer review.

276. **MR. BURKE**: Has there been an in-depth epidemiological study done of Aerojet employees, residents in this area, mainly residents in this area who consumed water that was clearly contaminated before we knew it was contaminated? I contacted the State of California, and in their database there was apparently no applicable data in this regard. I am just wondering if I missed something. It strikes me if you want to do what is right; you find out first how much damage you have already done, not just to the groundwater. We've been talking about groundwater and drinking water and all this business. But I do believe that dozens of people have died from this contamination. I say that only because I mentioned and we Discussed Aerojet's contamination in an environmental science class that I teach. And several students raise their hands, "Oh, my uncle used to work at Aerojet. He died of a thyroid condition." "My uncle used to work at Aerojet and he died of leukemia."

277. **MR. BURKE**: We know that these are diseases caused directly by these contaminants. Your first responsibility is to find out the extent of these health impacts.

278. **MR. BURKE**: We don't know that Fair Oaks was not exposed to TCE also. You are talking about one chemical, perchlorate. I just want to make sure how extensive your effort has been in ascertaining the extent of the damage you have done to the human health in this region.

279. **MR. BURKE:** It seems to me dozens, if not hundreds of thousands, of people who have died from this contamination. And it bothers me when people talk about drinking water because we are talking about human health. We are talking about longevity. We are not talking about 240 years. We are talking about 10 years ago these people died, five years ago these people died, and today they're dying.

If I'm angry, I apologize. It is awfully frustrating to me to have a highly educated panel and have this company spending tens of millions of dollars trying to come up with solutions and you haven't looked at the square one of what the risk is to this community of you actions.

I appreciate all your well-intentioned efforts. Really, step back a little bit and take a look at the community and what it is doing to the community, and you haven't done that yet.

280. **MR. VOETSCH**: Let's face it, not everybody is up front and truthful about these things and what is happening here. And for me I have to agree with these people in some cases because for me there is one, two, three, four, five, six, seven, eight, nine, ten people here and none of you can tell me whether or not that this water is safe to drink. Maybe now it is safe, but up until 1997 what were we doing to ourselves. This lady here covered that. What is happening to us.

281. **MR. BURKE**: I contacted the Department of Health Services and I've discussed this with them. They could not provide me with the data that we are talking about, that I am talking about.

USEPA Response to Comments #276 - 281: Prior to 1997, the California Department of Health Services (DHS) performed health consultations for exposure to perchlorate in groundwater for each of the water purveyor systems near Aerojet. A brief summary of the health consultations is provided below and are part of the administrative record or can be obtained directly from DHS.

- *Sunrise/Sacramento County – Prior to 1997, there may have been perchlorate exposure to workers served by this water system, but there is no monitoring data so exposure cannot be quantified. June 18, 1998 DHS Report.*

- *Arden-Cordova – Exposure to perchlorate may have occurred as early as 1987, but this exposure cannot be quantified because there is no monitoring data. The impacted wells have been closed; there is no current health hazard. April 21, 1998 DHS Report.*

- *Fair Oaks – There was no exposure. June 5, 1998 DHS Report.*

- *Citizens Utilities Suburban and Security Park – Water received through the intertie with the main base water system contained perchlorate (Mathers USAFB) for several months in 1995 and 1996 which posed a health hazard when the water was delivered to the Suburban System. March 18, 1998 DHS Health Consultation.*

- *Mathers Air Force Base Water Service Area – Prior to the base closure in 1993 there may have been perchlorate exposure but monitoring data is not available for confirmation. Exposure may have occurred to patients at*

the base hospital, employees, customers, and visitors in the Main Base Area prior to closure in 1993.

282. **MS. DUTEAUX**: But what it comes down to for me is that if we are just testing the monitoring wells we don't get to the fact of what people are really exposed to. What I am asking Region 9, Department of Health Services, Cal EPA and everyone else up there is please start testing the tap. We need to know what people are actually exposed to. And this is going to get beyond the two liters per day risk assessment idea of what people have consumed in terms of drinking water. But if we are only testing the water at the monitoring wells, we have no idea of actually what people are consuming.

That is drinking water; I am asking tap water. There was a study done down in Santa Clara when there was a semiconductor industry contamination of TCE throughout Santa Clara Valley. And their data were actually flawed because they didn't test -they only tested drinking water and that doesn't necessarily mean that gets to the tap specifically with VOCs. You need to do tap water monitoring. Please, for these people and their well-being test what is in their homes?

Things can dissipate. Chemicals can volatilize, particularly in the home. When we are talking about trichloroethylene, which is a suspected human carcinogen, not a known human carcinogen, Tom McCone, as you probably know, great exposure factors, has worked for Lawrence Livermore National Lab, for Berkeley National Lab, University of California at Berkeley, has said that consuming drinking water with TCE is not the primary concern. Its volatilization and its enclosed areas, including taking showers and having VOCs brought into the body through skin absorption and inhalation. You have to consider the route of exposure to the person being exposed. That is what I am asking about; not drinking water wells, which I think is an easy test to do. if you can make the effort like they do with radon testing, test it in the homes so we can get a much better idea of what people are exposed to.

USEPA Response to Comment #282: With over 10,000 service connections in the operable unit, individual tap testing would be difficult if not an impossible task. It is USEPA's assessment that it would not be sufficient to estimate exposure from a single sampling event as this would merely be a "snapshot" of what the concentrations were that particular day. To accurately estimate exposure, USEPA would need to sample tap water on an ongoing basis to take into account changes in the source of water over time.

USEPA believes that monitoring tap water in homes repeatedly over time would be logistically difficult to accomplish. More importantly, it is not the most effective method for responding to changes in water quality. USEPA believes it is better to evaluate water quality before it reaches people's homes rather than to wait until there are measured changes in water quality at an individual's home. Monitoring water at the source is also the most efficient means of responding quicky to any changes in water quality that may occur over time. Limited tap water sampling done by the Regional Water Quality Control Board has not

shown new contamination. Requests for tap water testing should be directed to the Californica Department of Health Services.

283. **MR. VOETSCH**: Now my question that I want to ask is with this group is there anybody that I can go to and find out what is happening? My doctor told us not to drink the water in Rancho Cordova because of our problem, so we are buying bottled water to drink. And it's an expense that I don't like to go through. I would like to know the lady here says we have safe drinking water. So maybe I should just go back to drinking the water here.

284. **MR. VOETSCH:** Are you - all I want to know is are you willing to tell me today or somebody On this panel that it's okay for me to drink the water and I have no more fear of thyroid cancer or thyroid problems. My family is - we have been in and out of hospitals quite a bit with this stuff, and I haven't been able to find anybody to give me an answer on whether or not this is a problem.

USEPA Response to Comments #283 - 284: The water meets Department of Health Services (DHS) requirements. The contaminated wells have been shut down. The water purveyors routinely monitor all of the drinking water wells, under the supervision of the DHS.

285. **MR. VOETSCH**: I am hearing these people talk today. I know you folks are doing the best you can. But I also think that with this young lady and the other one that just got up and talked and said that there is other things to look at. And I think that maybe you do owe it to us to give some sort of service to let us know where we are healthwise.

For me and my family this is a serious problem and I really come up here and I hear all about the different layers and areas that's been exposed to it. And my home is not on that map and yet doesn't tell me that maybe the well that they closed down was supplying the water for that area. I don't know. So these are a lot of questions that I have. I won't put you on the spot for all of them. I would like to know something about my health.

Response to Comment #285: The California Department of Health Services is looking into past exposure by examining hospital records and examining incidents of various cancers in order to see if there is an elevation or increase in the rate of thyroid cancer. It is difficult to know each person's past exposure because monitoring for perchlorate below 400 ppb was not possible before late 1997.

286. **MR. VOETSCH**: Just one last question. Is this affect, is it cumulative? In other words, we don't know how much I drank up until 1997. If I drank enough, does it continue to build or does it flush out of my system?

USEPA Response to Comment #286: Scientists currently believe that perchlorate has a cumulative effect in the body, but more studies need to be done.

287. **MS. KOSTLENIK**: I don't want the runaround. I want to know what is in my tap water, period. Tap water, number one, how do I test my tap water? You guys are scientists. Impress me, please.

USEPA Response to Comment #287: In order to collect tap water for testing, a certified clean plastic vial is needed. Latex or plastic gloves should be worn during the sample collection so that bottle is not contaminated. Fill the vial with tap water so there is no void space. Seal the vial, and take it to a certified lab that can do the analysis for perchlorate.

288. **MR. WILLIAMS**: I watched colleagues die. I myself was a lucky one. I take medication every day for a seizure disorder from nitrosamines that I had to work with, and I'll take them for the rest of my life, and I can control my seizures. But I have a seizure disorder and that is, you know, from some of the things that I worked with.

But what I want to do is to inform the people that the chemicals that they are talking about in this thing is just the tip of the iceberg. What happened is that Aerojet had certain facilities and they had certain permits to work with certain exotic chemicals. What they did is they created a company called Cordova Chemical Company that was designed that we will make chemicals that other people won't make because they don't have the facilities or they don't have the permits or other people won't make because they are just too massive. And at times out there they were working with stuff like dioxin. They made antimalarial drugs. They produced herbicides, pesticides, all kinds of stuff. None of this stuff is even being addressed at all by all of these people who are speaking specifically to, what, three chemicals out of 60,000 that we manufacture now.

And so what I need to do is to have we as the public get enlightened about what was produced out there and how do we test to see what there are. If your children are turning up with seizure disorders, it may be of something that is in the water that is not being tested for.

USEPA Response to Comment #288: The chemicals used at Aerojet were reviewed and the Occupational Safety and Health Administration (OSHA) material safety data sheets (MSDS), available for those chemicals were reviewed. Where MSDS sheets were not available (pre OSHA and no present day MSDS) the nearest related chemical was reviewed. See also Response to Comments #238-242 regarding testing.

289. **MR. LADD:** And then a general feedback from this whole process is involved. When something like this happens and people been exposed, there is a crying need for the government to respond with sending people out into the field, doing at least the superficial kind of health survey, contacting people who have all kinds of questions, and they are looking for authority.

When this first broke, basically the source of information was Brockovich. That's been a pretty chaotic process. For example, I just received information a couple weeks ago from

a young woman she just got lymphoma and five next door to in Arden-Cordova well ten. Now I'm presented with trying to figure out - the woman wants to know if the water had anything to do with her illness. I am a volunteer. I am presented with that challenge. And it seems like with all the money that is spend dealing with this problem, there should be some point of contact, some social worker or health worker who can do out in the field and give straight objective answers to these people who have questions.

It is a flaw in the process. For all resources that are being expended it wouldn't take too much to employ one or two people who have a basic confidence in public health matters to address all concerns so you don't get these off-the-wall questions, and then you have the hearings.

290. **MR. WAEGELL**: We talked about testing people in the area who drink the water, but has any testing been done of aerospace workers who - the 20,000 aerospace workers who work at Aerojet over a 20-year period and now that they are going off and they are getting older, they are getting ill, has any follow-up been done on these people, aerospace workers? The people belong to the unions that work there and bathed themselves and breathed this stuff, not only drank it.

291. **MR. WAEGELL**: I am just wondering if people working building rockets are exposed to a lot more of the raw material rather than a manufacturer might be. I think it would be a valid think to follow up on.

USEPA Response to Comments #289 - 291: The USEPA is not aware of any planned or pending aerospace worker health studies. The California Department of Health Services (DHS) is responsible for conducting health studies. In the past the DHS completed a cross-sectional study of the general population. A long-term epidemiological study would have to be done on Aerojet employees in order to determine their health risks associated with their work and home environment. A study would have to go back a long period of time to follow these people forward and see what kind of cancer they might develop, what kind of reproductive effect they have, what kind of birth defects their children have, and link it to the kind of exposure they have at work.

AEROJET WATER TRANSFER

292. **MR. WAEGELL**: My question is: Why doesn't Aerojet, if it is a good neighbor, give the 6,000,000 gallons it has, contracted surface water, clean water, to those, replace those two wells that it has polluted? And this needs to be done rather than coming down to the number six area and pump water out of the aquifer. The people down there don't like it.

No, no. What they are going to do is they are going to the north vineyard situation and put wells, deep wells, pump the water out, pump it up to Mather to clean it, and then provide water for the Sunrise corridor and the urban water district or something that lost two wells recently. This is the county's proposal. They want to come get water from us to replace two wells that were polluted by you. And my theory is that Aerojet with its

contracted water from Folsom, surface water, should provide that water to replace those wells. Don't come into our area and suck water out of our aquifer. Our aquifer is going down a foot and a half a year.

USEPA Response to Comment #292: Aerojet is looking for ways to provide for alternative water supplies. Groundwater contamination must be contained and cleaned up; this will require groundwater extraction. Aerojet has developed alternatives for remediation that balance costs, the need to extract and treat groundwater to contain and cleanup contamination, and the need to minimize the impact of groundwater extraction on the aquifer.

293. **UNIDENTIFIED AUDIENCE MEMBER**: Aerojet doesn't drink the water out of the plant, does it? The water on your property is imported from Folsom.

USEPA Response to Comment #293: The water that Aerojet uses comes from Folsom and is not contaminated.

294. **MR. KERSHAW**: My last question: Will you give us free drinking water for the next 240 years? And not from this area if you please. I ah mean, that sounds -

USEPA Response to Comment #294: Aerojet will continue to provide replacement water for wells lost due to contamination from Aerojet.

LEGAL ISSUES

295. **MR. WILLIAMS**: That means that the law has not changed about you owning a chemical until it is nontoxic?

If you manufacture a chemical, you own that chemical until it is nontoxic no matter where it goes in the world.

But the law hasn't changed?

USEPA Response to Comment #295: Aerojet is responsible for the operations on their property and for any contamination caused by its plant that may impact public health.

296. **MR. WILLIAMS**: Were you at any time in disagreement as to whose responsibility it was to clean this site, either yours out of your corporate coffers or your insurance company's, like Lloyds of London, Transcendental [verbatim] or any of those?

USEPA Response to Comment #296: Aerojet and their insurers have contributed money toward the cleanup efforts. The United States Department of Defense (DoD) is paying 88 percent of the allowable environmental costs pursuant to an agreement between DoD and Aerojet.

297. **MR. KERSHAW**: I want to know how cooperative Aerojet has been with the whole Superfund process, how much they spent on litigation, how hard they fought to take responsibility, and I would like someone from EPA to answer first, please.

298. **MR. KERSHAW:** You also - I just also don't think that you are starting to clean up voluntarily.

USEPA Response to Comments #297 - 298: The process of cleanup is proceeding much slower than desired. The USEPA has been working under a legal document called a partial consent decree. This partial consent decree governs Aerojet's obligation to prepare a remedial investigation, feasibility study for the site.

299. **MR. BURKE**: If Aerojet were to go out of business, what would happen? What would be the legal options of EPA?

USEPA Response to Comment #299: The USEPA would examine the assets of the Aerojet facility. The assets would include the Sacramento facility. USEPA would also look at the parent corporation, GenCorp, to determine whether GenCorp is legally obligated to cleanup the Aerojet Site. See also Response to Comment #258.

300. **MR. DUMONT**: How about if they decide they want to put it in my backyard; what recourse do I have then?

USEPA Response to Comment #300: To the maximum extent possible extraction wells will be located in commercial areas or in road right-of-ways where there will be minimal impact to private residences. Ultimately, members of the public have the right to petition elected officials to intercede on their behalf.

301. Comment deleted - Not related to remedy.

302. **MS. KOSTLENIK**: The other thing is, gentleman, Charles Berrey, you were saying that - I think you said if you knew that you could - about adjusting the base levels for children, which is currently not, and that you - I think you made an allusion to somebody is trying to get that information in there for you guys to change your base level.

USEPA Response to Comment #302: The USEPA's pending toxicological review will take into consideration the effects of perchlorate on children. The need for action and cleanup levels changes will be reviewed as new data becomes available.

303. Comment deleted - Not related to remedy.

304. Comment deleted - Not related to remedy.

305. **MS. WYANOSKY**: The next comment is, will Aerojet put in writing that they are responsible for the cleanup for 240 years, that in the generations to come they are responsible in writing and document it and signed by the corporation as it is now, today?

USEPA Response to Comment #305: The consent decree that will be negotiated between the regulating agencies and Aerojet or a Unilateral Administrative Order issued by the USEPA to Aerojet will be for implementing the selected remedy for the Western Groundwater Operable Unit.

ALTERNATIVES

306. **MR. CONNOLLY**: While we support EPA's preferred remedy, Alternative 4, we prefer the 4B variation of that alternative as opposed to the 4C variation that EPA has endorsed. Both alternatives provide equal protection to human health and the environment. We prefer 4B for a number of reasons. 4B will take less time to get implemented and up and running because it requires less construction than 4C. It is also more cost effective then 4C.

Importantly, we feel that 4B is the best approach for the Rancho Cordova community. With less construction, there will be fewer roads torn up, fewer traffic and congestion problems and much less destruction in a community that is actively working to improve and grow.

We will provide our technical reason for this alternative during the formal comment period. Let me emphasize that 4B, like 4C, will stop the plume and provide clean water. The bottom line, our goal and our commitment to you is to stop the plume and provide safe and clean water.

USEPA Response to Comment #306: It is true that there is less construction with Alternative 4B and the construction is phased-in over a longer period of time. However, layers D and E of the aquifer will be further contaminated under the 4B Alternative and it is estimated that the remedy will take an estimated 108 years longer to complete than Alternative 4C. As a result of the longer time to achieve cleanup it is estimated that two or three additional replacements of the piping and equipment would be required.

307. **MS. LUNCEFORD**: It is not being considered as part of the alternatives, recharge basins?

They are being considered? I didn't notice that in the plan. They are not specifically in the plan?

USEPA Response to Comment #307: It is USEPA's assessment that extraction of groundwater in this complicated aquifer and discharged to surface water will be more effective than reinjection. If the groundwater were recharged on

Aerojet's property, the size of the on-property containment system would have to be significantly increased and would not be economically viable.

D. Responses to Oral Comments Received During the January 17, 2001 Public Meeting

GROUNDWATER/SURFACE WATER CONTAMINATION

308. **MS. LAURENT**: Please help to cause independent, truly, truly independent testing of soil and water to happen east, north and south of Aerojet.

USEPA Response to Comment #308: The Department of Health Services does both announced and unannounced inspections and collection of samples from the public water supply wells to independently check for contamination. The regulatory agencies can collect split samples of soil and groundwater for independent analysis.

309. **GEORGE WAEGELL:** Another thing that is going on that the wells that have been polluted in the Rancho Cordova area by Aerojet will come down to Excelsior Road and Florin Road and dig wells, pump groundwater from there, and from our area, up through Mather, clean it in Mather, and use it to replace this polluted water from these wells that have been polluted by Aerojet. And this is sort of wrong when Aerojet has surface water, it should supply the water for the wells, not our area.

USEPA Response to Comment #309: The January 17, 2001 meeting was held as a forum for public comment on the Western Groundwater Operable Unit. The plume referenced in this comment is south of Aerojet and is migrating toward Mather Field from the Inactive Rancho Cordova Test Site (IRCTS). The IRCTS site was owned and operated by McDonnell Douglas and Aerojet at various times. The Regional Water Quality Control Board is handling this plume under a separate order.

310. **MARLA ARNOLD:** This is a little bit different, though, and I apologize for being late. The 4C that he was talking about is better than what they were doing the first time around, reinjecting it. But my main concern is this - - from talking to other people I discovered that the pollution and the long years of taking it, that the pollution is heavier than water and that it is down in underneath. So my interpretation is what is going on, you have new water coming in and it is affecting and getting hold and intersecting with that area of pollution because of you got your water tables and it seems from the bottom - - from the top going down, and then it comes in like your caverns and that also reaches that area.

From what I gather you are doing nothing to go after the actual pollution and removing it. That to me it sounds like you are going after the fresh water that is on top that becomes recontaminated, that wasn't contaminated and this is what you're cleaning up. So I have

heard nothing on any of the approaches that you have done that you are building any kind of wall to keep, to divert new water from reaching your plans that you show different levels of contamination.

So you are doing nothing to divert the water from reaching. You're doing nothing at the other end to build any kind of a wall to where you can get to the contaminants. And even if you get to part of this, it still doesn't settle the part if we don't go after part of those contaminants. Then it is going to go down and get more water levels.

<u>USEPA Response to Comment #310:</u> The source of the Western Groundwater Area plume is on the Aerojet property. Contaminated soil on the Aerojet property will be addressed in future operable units. The on-property groundwater containment system which is part of this operable unit (OU) will contain the contamination on the Aerojet Property until the future OUs are in place.

In the mid 1980's Aerojet began operating two interim perimeter groundwater extraction and treatment (GET) facilities along the western perimeter of the facility. These GET facilities were designed to prevent or minimize the off-site migration of volatile organic compounds (VOCs) in groundwater. Groundwater was extracted, treated for VOCs and then reinjected; this groundwater contained perchlorate, but perchlorate was not known to be a human health risk at that time. In 1992, USEPA performed the first toxicological review for perchlorate and determined that it was a health threat; however, perchlorate could not be detected in off-site groundwater using available test methods. In 1997, the detection capability for perchlorate was reduced from 400 ppb to 4 ppb and perchlorate was detected off-property. Reinjection is no longer occurring and the treatment facility was upgraded to include treatment for perchlorate.

The off-site plume poses a human health threat; Alternative 4C provides the best capability to stop the plume from migrating further because extraction wells will be installed at the leading edge of the plume in each layer. Groundwater extraction will provide containment (i.e., a hydraulic wall) for the plume. Over time, as contaminated water is removed by the inner on-site extraction wells, and outer off-site extraction wells, clean water will flush additional contaminants from the aquifer and eventually, the contamination will be cleaned up.

311. **MS. ARNOLD:** In your presentation you are saying we are going after this first, and after 240 years we will - -

312. **MS. ARNOLD**: What would be your time span? Can't you get more than one thing going at a time? And can't you give us - - are you going to have the wells in place and the purification plan and start doing the other?

313. **MS. ARNOLD**: That sounds like ten years too long.

<u>USEPA Response to Comments #311 - 313:</u> USEPA will not wait to complete clean up of the Western Groundwater Operable Unit (WGOU) before beginning to clean up another area with contamination. Due to public health concerns, the WGOU remediation will begin as soon as possible. USEPA is negotiating with Aerojet to schedule the Perimeter Groundwater Operable Unit as the next operable unit. The third area to be addressed is the interior portion of the Aerojet property. It is anticipated that there will be seven operable units for the site.

314. **JANIS HEPLE**: My name is Janis Heple. The main thing I think I am going to ask some questions about tonight are the wells in the area. But for those people who are newly helping to represent Aerojet, I mentioned at the last meeting that I have been following this site, not - - as you know, I am doing it as a volunteer. I am not working at it hours per day, and I would have needed to over the last 22 years. And I want to warn you that is very important to keep a lot of data on this.

At the last meeting the woman speaking on behalf of Aerojet who was on the panel talked about how it was impossible. She used the language, and there is people in the room who probably remember exactly what her language was, but she said it wasn't possible to detect perchlorate back in the late '70s. And in the EPA brochure they mentioned that it wasn't detected off-site. Well, that is correct. But it was detected on-site. It could have been being tracked all these years. And instead, it was reinjected.

And I guess what I would like to know is how aggressively are all the wells being tracked? Are wells - - from hearing this talk, I guess it was yesterday I got the distinct impression that very few wells in Sacramento County have had this technique utilized, and this technique is very valuable because it prevents the migration of the contaminants from one layer to another.

315. **MS. HEPLE**: I know you described it the last meeting, that these plumes are at least at three different levels. But all the dialogue in these meetings, a lot if it has been just on just the movement of the contaminants. If you could share a little bit with the audience on what is being done in this area, how aggressive this area is, given the different agencies that are involved. How you - - Larry brought up the potential for some migration past what has been defined. It that is the case, there would be wells in the way where contaminants could move? It would be valuable just to hear a little bit on this issue.

316. **MS. HEPLE**: I meant all the wells in the area, whether or not there has been a search for all wells in the area, whether they are lined or not. If not, is something being done, like the well that was just destroyed.

317. **MS. HEPLE**: I think I was getting concerned since it's taken 22 years to get to this point on the cleanup that I was a little bit worried of how much has happened to the others and whether given that this was the first well structured this way, in Sacramento County are there any other wells that are partially unlined and also need to be destroyed?

<u>USEPA Response to Comments #314 - 317:</u> The USEPA and State agencies evaluate Aerojet's groundwater monitoring plan each year. Agency reviewers evaluate all of the wells that are going to be sampled, consider if additional wells should be sampled, consider if additional monitoring should be conducted, and evaluate changes in the monitoring protocols.

The well that was destroyed was an abandoned well on a piece of property that was being sold. The owner of the property was required to destroy the well before the property was sold so that it wouldn't cause a cross-contamination problem. The Department of Water Resources (DWR) requires that if a well is not in use it be destroyed. Previously unknown wells on empty lots are occasionally discovered. In order to track down and identify wells that should be destroyed, the Regional Water Quality Control Board has scanned the DWR records since 1978.

318. **MS. ARNOLD**: They were sealed, but no contamination was removed so they can seep over to the present?

In essence they have done nothing to remove the contamination to where other things, that if there was a well there to begin with and water seeping and got into it at one time so the flow of water made it to there, during different circumstances because there was a well at one time as you have water seeping down in other ways so they left it there. That is why we are having 240 years, for the last 22 years they haven't removed dirt or contamination and sealed it?

<u>USEPA Response to Comment #318:</u> Contaminated soil still exists in the source areas on the Aerojet property. The priority is to protect public health by protecting the public water supply wells from contamination. The source areas will be addressed later. Also, see the Response to Comment #310.

319. **MR. ROONEY**: Peter Rooney. I have a question about the problem of detecting the perchlorate. My understanding is, Alex, you probably know it better than I. Perchlorate at high levels was easily detectable for a long time. It wasn't until about 1997 or so when Aerojet's staff devised a method of finding perchlorate at substantially lower levels that is where we really became aware of the fact that - - and I assume working with you, DHS or whoever they were working with - - that this new technology is what has allowed the detect of the lower levels we are talking about now. So it is really a relatively recent thing when anyone was able to detect this level that they can do now.

<u>USEPA Response to Comment #319:</u> See the Response to Comment #318.

320. **MR. LADD**: On the detection limit for perchlorate, which is very crucial factors, the IC two used to develop or detect for perchlorate as presently being used as an improved method was developed in 1983 by the Dyanex [phonetic] Corporation. In the first perchlorate conference in Las Vegas Dr. Peter Jackson, who works for Dyanex, stated

that in 1983 the ability to detect for perchlorate at a lever of 1 to 200 parts per billion percent using the IC method existed. It was adopted by the - - the problem with using the method in the plumbing at the time, it would take an hour before you would get the signal for perchlorate.

In 1986 the FBI - - Dyanex altered the plumbing so that you could basically use the method now to detect a couple hundred parts per billion. So in all practical purposes the ability to detect for perchlorate at a couple of hundred parts per billion existed when the consent decree authorized the use of competitive electrodes. So there was no technological barrier to tracking this plume given the core of 8,000 parts per billion. It is simply not true.

The issue is most intense to what happened in 1992. You did use your effort in 1996, but what happened after 1992 was inexcusable.

USEPA Response to Comment #320: It was possible in 1986 to detect perchlorate to 400 or 500 parts per billion (ppb). See the Response to Comment #310.

321. **MS. ARNOLD**: And back in the '70s I was working on Aerojet property, and I had heard that they had their own water purification plant. And they were furnishing. It wasn't part of Arden Cordova, or whatever.

Can you tell me what they were looking for back then in that water?

USEPA Response to Comment #321: Aerojet's water purification plant supplied the facility with treated water. Aerojet would have tested for standard water quality parameters like hardness, pH, iron, bacteria, etc. as required by the Department of Health Services. Eventually, Aerojet began receiving their water from Folsom. In the mid 1980s, Aerojet installed groundwater extraction and treatment systems to remediate the contaminated groundwater. For a list of analytes, see the Response to Comments #238-242.

322. **MR. KERSHAW**: I want to try this again. First of all, how sure can we be that there isn't pretty significant soil contamination on the Aerojet land? Sounds to me like quite a bit of glop has been dumped there?

323. **MR. KERSHAW:** Are there other things that don't wash out of the soil pretty well and they are still stuck there and haven't gotten into the groundwater?

USEPA Response to Comments #322 - 323: There is contaminated soil on the Aerojet property. In the case of NDMA, sampling indicates that there is very little soil contamination since it passes through soil to groundwater rather quickly. Perchlorate and TCE remain in the soil for a longer period of time. Aerojet has conducted sampling at many source areas to evaluate the extent and type of contamination in soil.

324. **MR. KERSHAW:** So the surface cleanup would have to be done to very good standards before they could develop it?

USEPA Response to Comment #324: Contaminated soil will be studied and remediated as appropriate prior to development of the Aerojet land. There will be an evaluation to determine if the property is clean. If necessary a land use covenant or other types of restriction on access to contaminated groundwater will be required. The USEPA's general policy is to promote the economic development of Superfund sites by allowing clean lands to be redeveloped and returned to productive use.

325. **MR. KERSHAW**: So the land that Aerojet wants taken off the NPL, what land is that?

326. **MR. KERSHAW**: But still, to be delisted or taken off the NPL, that would have to be tested and make sure it is clean.

USEPA Response to Comments #325 - 326: The land for which Aerojet wants an NPL site boundary clarification consists of approximately 3,000 acres that was not associated with their operations. A large portion of this land was used as an undeveloped buffer zone. In order for this land to be removed from the NPL site boundary, an assessment must be made that the land was never contaminated. NPL site boundary clarification is different than NPL delisting which applies to land removed from the NPL through the remediation process.

PLUME BOUNDARIES

327. **MS. LAURENT**: I am really glad to see that you have an aerial photograph. I live abutting federal property in a subdivision near Lake Natomas' shores. Regarding this, I would like to make a number of points. The first one, the contaminants which damage our lives and health do not recognize political or ownership boundaries, so I ask that the government should not try to bind these poisons to map boundaries but follow their actual extent. I ask you not to allow any construction on any property owned by Aerojet because we do not know at this point with any scientific certainty the extent and nature of the poisons and the dangers.

328. **MR. SMITH**: No it don't, because it still gets into our water. There is no way that you can prove to me that it's not. You can stand there and say it is not moving, but I know enough to be about it that it's moving. And unless you're standing down there and got it dye-code to see where it is moving, then you don't know what is going on. And I am not stupid to a certain degree.

329. **MR. LARRY LADD**: I would like to thank you guys for adopting such a strict standard in drinking water. There is no doubt in my mind that 1.3 parts per trillion of NDMA and less than 4 parts per billion of perchlorate is protective of public health.

I want to thank you for adopting that instead of - - given the fact that we started the process. Three years ago Aerojet said they had a study that said that 40,000 parts perchlorate was safe. I am glad you adopted the standard that you did.

The first question concern is on - - and most of you heard these or read them on E-mail before - - is whether we fully address the full extent of the perchlorate from Aerojet? And if you look at the history of perchlorate at this particular site it is a very interesting history. In 1963, January 1963, the State of California surveys around the Aerojet site and Mather Field for perchlorate. And then the admiral who is the father of the Polaris missile becomes vice president of Aerojet, and the monitoring stops. Then State Water Board Order 133 comes out and says certain compounds that may degrade groundwaters cannot be disposed of, such as ammonium and potassium perchlorate and contaminated trichloroethene are collected and sealed in approved containers and dumped at sea in approved dumping areas.

So the perchlorate problems sort of went off the screen in 1963. That admiral went on to be the Director of the CIA.

In 1979 when the process for the main gate of Aerojet, 800 some-odd parts per billion, TCE was found in the drinking water wells that served Aerojet Federal Credit Union. And Aerojet said, "That is not our TCE. If it was our TCE it would have a perchlorate in it." So the State Water Board goes out and tests and finds 300 parts per billion of perchlorate. And partly because of that process the Superfund was born.

But when this program was established, the vice president from Aerojet became the head of the Superfund and perchlorate problems were dropped off the screen again. I'm confident that you're addressing - - and the name of that head is Rick Lavel. This is the plume I would imagine that comes from the dumping of perchlorate in the late '70s and early '80s.

My concern is the perchlorate that was in the earlier years of Aerojet, from 1956 to the early '60s, back when I presume it was discharged into the American River and into an active dredger mine, which was more diluted at that time. That would be the perchlorate concern that was addressed in the 1963 report. My concern is that water - - the perchlorate may be a very low level but is further downgradient towards Watt Avenue, near the Rosemont, Lincoln Village, that area. And I am not concerned about the one or two three parts per billion perchlorate. My concern is that there may be other contaminants at a lower level that could have a toxic affect. I understand from your limit you are going to be looking for aquifers less than 4 parts per billion. That is very protective.

<u>USEPA Response to Comments #327 - 329</u>: Extensive groundwater sampling has been conducted to determine the extent of the Western Groundwater Operable Unit contaminant plume. Aerojet analyzes some samples for tentatively identified compounds or TICs; TICs are chemicals that are not

included in the standard analyte lists. The agencies require Aerojet to conduct an annual evaluation to determine if there are methods to analyze for additional chemicals. Also see the Response to Comment #159.

330. **MR. WAEGELL**: Another thing was said here that they brought up the groundwater pollution is getting to Watt Avenue. And I live by Kiefer Landfill and we've had a lot of problems out there. And I notice that the aquifers only travels, say, 150, 500 feet a year, but your pH will change a great deal. It will travel 3,000 feet in a year. And so this is something they could look for in the wells downstream because these chemicals may change the pH. And that is another thing that we ought to be looking at.

USEPA Response to Comment #330: The remedial investigation has not shown Aerojet contamination to extend beyond Zinfandel Dr. Watt Ave is much further to the west.

WATER TABLE/AQUIFER

331. **ELLEN DOVE**: Mr. Mac Donald was recently at the CORE PAC meeting, the planning commission from Rancho Cordova, Planning Advisory Council. And at that meeting - - and nobody mentioned it here today except that I saw it vaguely referenced in one of your slides. One of the plans to replace - - because they talked a lot at the other meeting about if you take the water out what do we do? Because otherwise the aquifer is going to drop, the water table is going to drop. Everybody's wells are going to be - - people are going to have problems on their agricultural properties and everything else.

USEPA Response to Comment #331: The water table is expected to drop approximately 30 - 35 feet due to the extraction of contaminated water.

332. **MS. DOVE**: As I understood it, there was a proposal and I didn't know how far along, whether there was a contract or just a suggestion. It was my understanding that 3,000 gallons, I guess, per minute was a potential replacement.

333. **MS. DOVE**: And I heard, correct me if I am wrong, that they had an agreement of some sort with the City of Folsom to provide that extra gallonage.

334. **MS. DOVE**: Has that contract been approved by the City Council and it's something that's been on the agenda and public record?

335. **ELLIC SOMER**: It looks to me if you're dealing with Folsom, you're dealing with a bunch of screwups. That is all I can say is, whatever involves cleaning this up involves the City of Folsom, watch out.

USEPA Response to Comments #332-335: In order to replace water from public supply wells that have been shut down due to contamination, Aerojet has a contract with the City of Folsom for the next three years which will provide 800 to

1200 gpm average yield to the Rancho Cordova area. In addition, Aerojet is installing a well at Rossmoor Park which will have a capacity of 1500 to 3000 gpm.

COST

336. **MS. DOVE**: And my second question was to do with costs. I notice that you mentioned something about how this is going to be funded, and earlier it was mentioned that it was going to cost $15,000,000, someone else who is here, perhaps he is going to speak on it.

I don't know, Larry Ladd said to me that there was an agreement between Aerojet and the U.S. government regarding who would pick up if there was contamination or problems. And that the government, the federal government is going to pay 88 percent of these costs.

USEPA Response to Comment #336: Aerojet has an agreement with the Department of Defense to reimburse them for 88 percent of allowable environmental costs they incur at the Sacramento site.

337. **JIM EMBREE**: The recent focus on perchlorate has resulted in considerable new information related to its potential for adverse health effects. The federal government with the assistance of Aerojet and other companies involved in cleaning up perchlorate in the environment have supported a number of studies designed to provide data for determining the appropriate drinking water standards. Results of those studies and a federal EPA recommendation for an appropriate drinking water standard should be forthcoming within the next few months. The current thinking is that the new standard for perchlorate is likely to be higher; that is, less stringent than the current standard.

USEPA Response to Comment #337: See the responses to Comments #271-274.

338. **MS. DOVE**: The 15,000,000, was that Aerojet's portion or was that the entire cost?

Of the hundred million, the federal government will pay 88,000,000 and Aerojet will pay 12,000,000, if my math is right. Is that correct?

USEPA Response to Comment #338: The 30 year present value cost for Alternate 4C is approximately 111 million for surface water discharge. The difference between Alternate 4C and 4B is 12.9 million. Aerojet has an agreement with the Department of Defense to reimburse them for 88 percent of allowable environmental costs they incur at the Sacramento site.

339. **PETER ROONEY**: But in reality, if you read the U.S. EPA documents for the long term and full extent of the process, as I see, 4B which Aerojet is supporting, is actually the more costly alternative.

<u>USEPA Response to Comment #339:</u> There is a 12.9 million dollar difference between Alternative 4B vs 4C over the first 30 years of the remedy. There is also a 108 years' difference in remedy duration between Alternatives 4B and 4C. Alternative 4B is estimated to require 348 years to complete, and Alternative 4C is estimated to require 240 years to complete. Remedy 4B is more expensive because there are 108 additional years of operations and maintenance costs and because the treatment plant and associated piping must be replaced three additional times.

HEALTH

340. **ROBERT E. SMITH**: Four years ago my wife passed away from kidney failure. Last week I was notified I might have the same thing. What World War II was persecuting the Nazis for crimes against humanity. To me this is a crime against humanity.

You have poisoned our water and all you think about is doing something that is going to take 240 years, which is not going to do me any good. It's not going to do my kids any good, and it's not going to do my grandchildren any good. The only thing that you can do now is make Aerojet build a big water treatment plant and purify that water so we can use it. And we don't have to take and drink water that can still be contaminated. I don't care how hard you guys pump. It can still get into our water. It may not go a lot, but it can get enough.

And I am tired of this doggone company, big companies, screwing up our atmosphere, screwing up our groundwater and our water. Something's got to be done. EPA is supposed to be here to protect us, not the companies. And the same thing with the politicians. If they want to protect them, let's get them out of office, and let's get this stuff straightened up. I am getting tired of this baloney.

<u>USEPA Response to Comment #340:</u> See the Response to Comment #310.

341. **MR. LADD:** The next concern was in the realm of NDMA. In the four wells in northern Rancho Cordova where at least one time or another there has been transient detection of NDMA, also in the same census track where working in the Aerojet health system three years ago where there was an elevated incidence of cancer amongst females in the census track, just beyond the 99 percent confidence interval.

So while there is no way that I can imagine an transient hint of a couple parts per trillion NDMA might be responsible for that, there is a lot of uncertainty in terms of is there a larger concentration that would lead us to et cetera, et cetera. So, what I would ask is that before - - obviously, there very conservative levels can go up once we have better science and better margin of safety. I would ask before we turn those wells back on that we take a good look at this higher incidence of cancer and maybe do a health survey. If it looks like there is no relationship within no mechanism of NDMA, and I am going to submit a handout that I gave to the folks at CORE PAC that addressed that, my request would be

that before those well are considered clear and turned on that this potential for association of health be addressed.

USEPA Response to Comment #341: The Regional Water Quality Control Board does not oversee whether or not certain wells can be used. The RWQCB oversees the water that is getting to wells. The Department of Health Services Office of Drinking Water regulates the water supply wells and the concentrations of contaminants that can be detected before those wells can no longer be used as a public water supply.

342. **WILDON HEAD**: I was wondering if there is any behavioral modification we can make as citizens to mitigate the health risks association with these contaminations? Can we drink less water or take fewer showers? I am not being sarcastic, but would really like to know.

USEPA Response to Comment #342: The USEPA does not believe that the public is now being exposed to any contamination because the contaminated public supply wells have been shut down. Based on data from groundwater wells tacking the contaminant groundwater, the potential impact on other supply wells will be assessed and predicted.

343. **MR. HEAD:** When you say the 1.3 parts per trillion, there was an implication of 1 in 1,000,000 cancer cases or something.

But there is a hundred thousand folks here in Rancho Cordova. So that makes it one for every ten persons who will likely experience - - no, that's not right, the right math.

USEPA Response to Comment #343: 1.3 parts per trillion is the estimated incremental one-in-a-million cancer risk. The added risk would then account for another one-in-a-million on top of normal lifetime cancer risk. The population of Rancho Cordova would have to reach a million for the risk ratio to equal one person.

344. **MR. SOMER**: You said that there was a time when we didn't know the perchlorate was a hazard. And how do they determine that chemical is a hazard? I am just curious on that. How do they spot that perchlorate might be a health hazard?

USEPA Response to Comment #344: Under the Toxic Substances Control Act (TSCA), chemical manufacturers and importers must notify USEPA about the characteristics of new chemicals they manufacture or import. With respect to chemicals already on the market prior to TSCA, USEPA evaluates the risk posed by such chemicals at a Superfund Site based upon the information available at the time. In the case of perchlorate because the chemical was found in the groundwater and there was no toxicity data, the USEPA requested a toxicity review in 1992 by USEPA's National Center for Environmental Assessment

(NCEA). NCEA reviewed the available scientific data on perchlorate and provided a provisional assessment that the chemical toxicity.

345. **MS. ARNOLD**: My question is: That like my house was built in the '60s and there was - - Aerojet knows what they were putting in the ground and et cetera, from lead and other types of stuff. I don't have all the data.

Is it possible that this form could have gotten in our pipes and built up like your arteries an clogged, and if it flakes off, come in and contaminate us? Has anybody thought to go into a home and check one of the old pipes to see if we are being continuously - - you know, you have your fresh water that you are worried about. So that was my question. Have they thought about checking the pipes, you know, like the air, the water, the buildup. I don't know all the different kinds of chemicals in lead that builds up and what happened if it flakes off and gets to us?

346. **MS. ARNOLD**: Aerojet has used all different types of chemicals and et cetera, with all different types of components which I don't know the names of all of them. So even though you have your chlorine and your other stuff that builds up in there, I am saying has anybody taken a pipe from, let's say Paul Mitchell School that has been here all these years and looked at it and analyzed it to see if there is pollution there? Something that we hadn't thought about that is from cleaning these big engines and et cetera. Like you said, in the ground besides your perchlorate, your TCE and all this other stuff.

I said, I don't know the answer. I am curious because I know I changed the plumbing once a few year back and I'd seen a buildup. What happens if it breaks off? Is there stuff from what Aerojet used?

347. **MS. ARNOLD:** The water is different, though.

The water is different than the actual pipe. You've got movement and things breaking off.

348. **MS. ARNOLD:** If you haven't analyzed one, then you don't know whether or not that stuff that you have used has created another problem that's similar to the - - you know, we didn't look for it; we've only decided to look for it. This was my thing, would it really hurt to sample an old pipe to see what is in there, that maybe there is more to it than what you think is there?

<u>USEPA Response to Comments #345 - 348:</u> The types of chemicals that contaminate the ground water do not adhere as scale to pipes that can break off and migrate into the water supply.

349. **MR. LADD:** Along those lines in terms of the NDMA, I was discussing with Robert why, you know, given the minuscule amounts of NDMA detected, could that possibly have a medical health effect, that his speculation as a hydrogeologist was to look to see if NDMA adhered to clay colloid. Because they do flush the system from time to time.

And if you're dealing with imprinting, the methylation not only methylates the site but it methylates the enzyme that keeps the site clear.

So for a child, for example, if you had a big rush of NDMA when they were flushing the pipes, then you might do such a genetic damage. That was his question, as to whether it could collect in colloid and sort of low spots in the system, and when they are flushing the system everybody gets exposed to a lot more than what you are taking in, and is dangerous as well.

We are talking adhering to clay, not precipitation.

USEPA Response to Comment #349: NDMA does not readily adhere to clay particles; it readily washes through the soil column.

350. **MR. LADD:** Is there literature on fate and transport for NDMA that I could look at?

USEPA Response to Comment #350: USEPA has provided Mr. Ladd with information on the fate and transport of NDMA.

REMEDIATION

351. **SANDY SMOLEY:** Let me take this opportunity to address two issues on which I have heard significant community concern: 1) the long proposed period of time necessary to complete the cleanup and 2) Aerojet's commitment to address the environmental responsibilities.

The company can move or go out of business and abandon the site. Under Superfund the Aerojet cleanup will be overseen by state and federal agencies that will see to it that Aerojet proceeds with the cleanup for as long as it takes. The federal government, through the U.S. Department of Justice and U.S. EPA will be kept in very close watch on the financial conditions of the company to ensure that the cleanup is appropriately funded. GenCorp is a public company that is now headquartered in Sacramento. GenCorp assures me that it has every intention of remaining in Sacramento and using the Sacramento facility as a base to conduct its worldwide activities and has announced these plans to its shareholders and financial analysis.

The Aerojet property, some 20 square miles, is one of GenCorp's major assets. In order to protect the value of that property, GenCorp must ensure the public that it will proceed aggressively with the cleanup and will with the oversight agencies take all those steps necessary to protect public health and the environment. As you raise these issues, like these, I intend to get the community the answers they need.

USEPA Response to Comment #351: The USEPA treated all of the remedies equally and ran the groundwater model to predict the time to capture one pore volume for each alternative. By treating the remedies equally, meaningful

comparisons could be made. It is overly optimistic to estimate cleanup time in the 15 to 20 year time frame; for any of the alternatives presented in the Feasibility Study a single volume of groundwater will not have been extracted in 15 or 20 years. Also, it should be noted that in Alternative 4B, two wells will not even be installed until 20 years has passed and three wells will not be installed until 40 years have passed; it will take additional time to capture one volume of contaminated water beyond the 20 or 40 years it takes for the contaminated groundwater to reach these wells. USEPA estimates that after flushing groundwater through the operable unit six times using the pump and treat system the aquifer will be cleaned up 280 years for Alternative 4C.

At the December 07, 2000 public meeting, Aerojet said that it is legally committed to continuing efforts to clean up the Site.

352. **MR. ROONEY**: EPA's remediation time estimates, as Ms. Smoley pointed out, assumed all the effective groundwater will be pulled from the aquifer six times and each time treated to meet drinking water standards. Again, as was pointed out by Ms. Smoley, the reason for the repetitive treatments is that when the water is pulled out of the aquifer and treated, the aquifer will recharge itself with new water and that new water will pick up contaminants that are present in trace amounts in the soil and that new water will then be removed and treated until the water meets the cleanup goals.

EPA has determined that it will be necessary to repeat the process six times to remove all the contaminants to the stringent safety levels. Both EPA and Aerojet agree that the bulk of the contaminants will be removed in this first pass, dramatically reducing the amount of contamination early in the life cycle in this cleanup process. The speed of the cleanup is limited by the speed in which this water can be drawn from the aquifer without causing other adverse impacts. The system proposed is designed to remove the contaminated water in an optimum capacity.

<u>USEPA Response to Comment #352</u>: See the Response to Comments #160-165.

353. **MARK EMMERSON:** So whatever solution you have and the discharge that you do, there are concerns. We do have a couple concerns associated with any solution that you have. These concerns are going to addressed to you more formally in some comments and some letters coordinated with the City who also takes water from the American River. Whatever is discharged must meet MCLs established by safe drinking water. That is - - you should not be putting anything into the river, anything that should not be drinkable. That is what we are looking at.

<u>USEPA Response to Comment #353:</u> Any on-site surface water discharge will comply with the substantive requirements of an NPDES Permit which will be contained in the Record of Decision; discharge to surface water off-site will require an NPDES Permit.

354. **MR. EMMERSON:** There has to be a good monitoring and notification program, a requirement associated with that discharge, so that if anything does happen, if there is an occurrence of a problem we are notified so we can get off the river, get on our wells and take that mitigation step or to mitigate the problems associated with taking contaminated water. The monitoring program should try to be as realtime as possible. I know that you can't - - everything is a snapshot. But we are taking a look at frequency associated with those snapshots.

USEPA Response to Comment #354: Any surface water discharge from OU-3 will be monitored. Should a detection of chemical contamination occur above discharge limits the Record of Decision for OU-3 will require notification of water purveyors.

355. **MR. EMMERSON:** Finally, the mixing and dilution should occur in some type of controlled fashion. You should not rely upon the river or discharging it for a 50 dilution, 50 degree dilution factor. You are going to take the river water, have it do good mixing to meet those MCL requirements and then discharge it. Don't just put out, put the material out there and hopefully the river will dilute it. Make sure that the river is diluting it by having a controlled mixing and dilution program.

356. **MR. EMMERSON**: The system that you develop should be a validated system, with protocols and procedures, looking at equipment qualifications, the operation qualifications, and so forth, to make sure that system is going to operate appropriately in all the conditions, worse case conditions included, so that we don't look at contaminating levels.

USEPA Response to Comments #355 - 356: See Response to Comment #353. Also, the exact design mechanism for surface water discharge has not been determined at this time. This issue will be addressed in the design phase.

357. **NORA KOSTELNIK**: A toxicologist friend of mine said that someone at U.C. Davis said that in about six months, roughly speaking, EPA supposedly is going to have some new standards on perchlorate. And that is my first question for her is she wanted to know if we are coming up - - if all of us are coming up with a remedial plan, what if a plan gets approved before these standards are out? That is what she was concerned about. So that is an easy one, sort of easy question.

USEPA Response to Comment #357: See the Response to Comment #245. If the perchlorate standard changes after the Record of Decision (ROD) is approved, the ROD will be amended if the new risk for perchlorate exceeds the USEPA risk range.

358. **MR. LADD**: I would suggest before you start that drilling process you might be more economic to use the best available detention technology for perchlorate to research all of the drinking water wells on down to Watt Avenue. My understanding is that at Sunnyvale - - I forget the name of the outfit that developed the IC. They can get a

hundred parts per trillion now in drinking water. There is some guy with the Research Council of Canada, 50 parts per trillion. Use that technology to sort of resurvey to see if there are any regions with low level perchlorate that perhaps you have another problem that you need to address. Since you'd like to sort of find a solution, you might want to consider doing that.

359. **MR. LADD:** Obviously the practicality is going below 4 parts per billion depends on how you see you can do it. It is just a thought for future reference.

USEPA Response to Comments #358 - 359: See the responses to Comments #159 and #194-196.

360. **MR. LADD**: I saw very recently something where the Public Utilities Commission made a ruling in conjunction with the DHS where, if I understood it correctly, temporarily you can serve water that is one order of magnitude above the MCL. Is that correct? And so is it possible to say perhaps in times of drought when Folsom needs water and everybody needs water, that some of these wells that are shut down now can come back on line, at least temporarily? I believe the figure for perchlorate that DHS has come up with is 40 parts per billion. Therefore, temporarily those wells, most of these wells come back on line if needed.

USEPA Response to Comment #360: The Department of Health Services (DHS) has established interim action levels for NDMA that are much higher than the Remedial Action Objective level included in the proposed plan. The interim levels can be used for a short period of time in an emergency, but DHS requires the water purveyor to notify consumers that the water that will be delivered to them contains contaminants at higher concentrations than normally allowed. The Arden Cordova Water Service would not turn on wells that have been closed unless it was absolutely necessary such as fire suppression.

361. **MR. LADD**: The last question has to do with Mitchell Junior High, something we've discussed before. I was hoping perhaps as part of the overall remediation, especially since perhaps you are going to be putting an extraction well on the Mitchell Junior High site, there is still an irrigation well that the school district runs. As part of this massive cleanup you can give some guidance to the school district as to when they should either stop using that well, at what level of contamination they should stop using that well or not even bother with that and just give them an alternate supply since you are going to be out there doing piping, what have you.

It is a minor point, but it is one of those things that could be overlooked. If it is within the realm of doing cleanup, can you establish communications with the school district and work this out somehow?

362. **MR. LADD**: I guess my concern is since you're spending all this money to remediate the whole kit and caboodle anyway, isn't this the time sort of to take care of an alternate supply rather than to take the time and energy to monitor something? Granted, it isn't a

problem now, but if something that is forgotten and left till later, that is just my suggestion.

USEPA Response to Comments #361 - 362: Aerojet is required to collect samples from the irrigation well at the Mitchell Junior High on a monthly basis. At certain times of the year, perchlorate is detected at concentrations that are well below the MCL. This water is only used for irrigation; this use does not pose a risk to human health.

363. **GEORGE WAEGELL**: I was wondering how Aerojet has cleaned up its other sites in California, what record it has of cleanup. The cleanup here historically since they started has been the solution to pollution is dilution, and they're still doing it, the same technology. They pull the water out of the ground and they treat it for TCE and air stripper and they put the TCE into the air. This is another dilution situation where he dilute it into the air.

USEPA Response to Comment #363: Aerojet is a potential responsible party (PRP) along with other PRPs for the San Gabriel and Baldwin Park sites. The remediation efforts are similar to the proposed Western Groundwater Operable Unit remedy except that the treated water will be used as a drinking water source.

364. **MS. ARNOLD:** What has Aerojet done knowing the wells were contaminated? Have they made any efforts to go in and actually take out contaminants?

They said they spent all this money and doing this for our benefit and they know they dumped this stuff because at the last meeting there was pictures of how they dumped all the stuff in the well. Aerojet has known this from what she was saying for 22 years. Has Aerojet made any efforts to go in there and take out the contamination or have they just blown them up?

USEPA Response to Comment #364: Since the mid 1980s, Aerojet has extracted and treated contaminated water extracted from perimeter wells on the Aerojet property. Remediation of source areas will be addressed in the future as separate operable units.

365. **MS. ARNOLD**: Aerojet has not taken the initiative on their own, knowing that this problem existed, to clean or contain any of the contaminated dirt or anything. Is that right?

USEPA Response to Comment #365: Aerojet placed extraction wells on the perimeter of the facility to help control the groundwater plume so that groundwater contaminated with volatile organic compounds would not migrate further off-site.

366. **MS. ARNOLD:** I had heard that they had their own water purification plant, and I was curious.

<u>USEPA Response to Comment #366:</u> In the past, the Aerojet purification plant treated groundwater for facility use. Aerojet currently receives water from Folsom.

ALTERNATIVES

367. **MS. KOSTELNIK:** The second thing is that in the things that I have been able to find out, basically EPA is going to - - is the decision maker, and in a sense Aerojet and us, you know, regular folks here in a sense are kind of on the same level, that we are adding comments. They actually have another plan. So I wanted to encourage regular citizens to remember that and that I think from what I heard we can actually make a difference to say that there is a plan we prefer. All I have seen is two.

I for one prefer the EPA standard. And I'm just going to make a quick suggestion to us regular folks. If we can just try and take out the particulars of the two parties, like the EPA face of it and the Aerojet face of it, if we can just use common sense that any - - just the way humans work. If you have an institution who's founded on the idea that your job is to be sort of a watchdog for government and for companies, and then if you are founded on a business like any of us who has a business, we know that we need to be penny conscious, and that is not good or bad, that is how you run business.

So I would just like to ask people to consider that, whether or not you think somebody is good or bad or whatever, use your common sense. If EPA is set up for this purpose, to be a watchdog, it is - - you don't need to be a specialist or a rocket scientist to figure out that probably it is a better plan, the one that is more in depth. And obviously if you take a look at 4C, it is more in depth with more extraction wells and closer up to the plume.

So, anyway, that is my suggestion. Also, you can have a voice and you can call this guy. His job is community involvement coordinator. And I'm thinking it is best to send him messages and tell him your name and say, "I support EPA's 4C measure." This is, like, what we do here. And it actually makes a difference, and they do hear your voice.

There is a lot of lawsuits going on, and I think that if a whole bunch of people call and say, "Look, we want 4C and we are the people who live here," that'd probably have an affect. When you go home and feel depressed, you might want to write to EPA, and Don Hodge, 1-800-231-3075. He also has E-Mail. You can get it from him. Those are the easy parts.

368. **MIKE RASLER**: I am a resident of Rancho Cordova. I am also an educator, secondary and post secondary. My Doctorate degree is in health science, so you can pretty much see what my interest is.

I just in listening to everybody's comments and particularly your input as representatives from the EPA I want to support 4C. I think as a resident specifically I am for the more aggressive approach. And as far as the disruption is concerned, that is an easy thing to put up with down Zinfandel or whatever. There are other tributaries that we can take. I appreciate EPA's effort. I support it wholeheartedly.

USEPA Response to Comments #367 - 368: The USEPA is confident that Alternative 4C will provide the best remediation strategy for the Western Groundwater area.

CREDIBILITY

369. **MR. WAEGELL:** What I see here is Aerojet sort of schmoozing the public and bring officials to back them up. And I think the public is being badly served. Aerojet polluted the water in Rancho Cordova and it has a responsibility to replace it with clean water.

370. **TOD KERSHAW:** Mainly I want to agree with what George said. I feel like we are being schmoozed here. And I wonder if we can get a show of hands from Aerojet people or people who are here on behalf of Aerojet, being paid by them or asked by them to show up or whatever.

371. **MR. KERSHAW:** What I am saying is I feel like there is foot dragging going on here mainly on the part of Aerojet. They don't want to spend money, which is understandable. I am trying to understand what is going on here.

USEPA Response to Comments #369 - 371: Aerojet is performing the Remedial Investigation/Feasibility Study and as stated during the December 7, 2000 public meeting Aerojet has paid for two new water supply wells, and the City of Folsom is supplying interim water.

LEGAL

372. **MR. KERSHAW:** One question I do have that's been on my mind since this whole thing started is there is some sort of litigation going on between, I don't know the EPA and Aerojet. I was wondering if we could know what that is and who is suing who or just what is going on with that.

373. **MR. KERSHAW**: Did they do it on their own initiative or at that time?

USEPA Response to Comments #372 - 373: A water purveyor is currently suing Aerojet and the State of California. The USEPA and the state sued Aerojet and GenCorp in 1986. In 1989, Aerojet and GenCorp entered into a partial Consent Decree under which they agreed to perform an Remedial

Investigation/Feasibility Study for the Site. A federal court is overseeing implementation of that decree.

374. **MR. KERSHAW**: The other thing I want to get to, I was - - there is no litigation apparently. But from something somebody said earlier I was wondering what negotiations are going on and what the ramification is of the negotiations and how maybe that can sort of evolve into a lawsuit.

<u>USEPA Response to Comment #374</u>: USEPA and the state sued Aerojet and GenCorp in 1986. In 1989, Aerojet and GenCorp entered into a Partial Consent Decree under which they agreed to perform an RI/FS for the Site. A federal court is overseeing implementation of that Decree. Negotiations are currently proceeding to modify the existing partial consent decree to break the site up into operable units so remediation can be expedited at the Aerojet Site and a review of the site boundaries is being conducted.

375. **MR. KERSHAW**: Does this mean if EPA chose 4C, Aerojet could say we have this partial consent decree which doesn't include the operable unit, so we will have to go to court over this? And this would mean that nothing happens for a while.

376. **MR. KERSHAW**: How can they justify not implementing 4C? What tools do they have to say, "No, we don't want to do this?"

<u>USEPA Response to Comments #375 - 376:</u> The partial consent decree covers only the remedial investigation and feasibility study for the entire Aerojet site. Once the Record of Decision for the Western Groundwater Operable Unit is issued USEPA will either enter into a Consent Decree with Aerojet or issues a Unilateral Administrative Order to Aerojet to implement the selected Remedy. The USEPA feels that its preferred remedy, Alternative 4C, is feasible and can be implemented successfully.

ALTERNATIVE PREFERENCE

377. **MS. KOSTELNIK**. – ....if you take a look at 4C, it is ... closer up to the plume... I support EPA's 4C measure.

378. **MR. RASSLER** – ....I want to support 4C.

379. **MR. KERSHAW** – I want to go on record of being in favor of 4C too.

380. **MS. ARNOLD** – The 4C that he is talking about is better than what they were doing the first time around.

<u>USEPA Response to comments #377 - 380:</u> Comments will be included in the public record.

E. Responses to Comments Received by Mail and by Email.

381. **Comments Received from Southern California Water Company.** In Appendix D on pages D27 through D29 wherein the plans for alternatives B and C are spelled out with seven bullet points each, bullet point 3 under both alternatives indicates that SCWC's Arden Cordova wells 1, 10 and 20 will all be turned off in calendar year 2001. This represents a loss of water supply to Arden Cordova of 3,675 gallons per minute. Nothing in the proposals address the loss of water itself, the cost of replacement water, a source of replacement water, potential infrastructure costs, or the loss to SCWC of water rights. How are these issues to be addressed?

USEPA Response to Comment #381 - One of the Remedial Action Objectives (RAO) for the Western Groundwater Operable Unit (WGOU) is "protect public drinking water wells through short-term and long-term contingency plans for alternative water supplies." The groundwater model predicts that Arden Cordova wells #1, #10 and #20 could be contaminated in 2001. The specific time these wells will be lost to service is unknown. It is USEPA's understanding that these three wells have a maximum daily water supply capacity of 3,400 gpm (well #1 capacity is 400 gpm, well #10 capacity is 700 gpm, and well #20 capacity 2,300 gpm). The average day flow from these three wells is considerably less. Presently, Aerojet has a three year agreement with the City of Folsom dated July 3, 2,000 for a 3,000 gpm alternative water supply. Under present system restrictions, it is estimated that the maximum daily capacity available is approximately 1,200 gpm to maintain the 40 psi pressure requirement per the Folsom agreement. In addition Aerojet is presently in the process of installing a new water supply well in Rossmoor Park which will have an estimated maximum daily capacity of 2,000 to 4,000 gpm. Aerojet has proposed to tie the Rossmoor Park well into Arden Cordova's 16 inch main in Colma Road to provide adequate alternative water capacity. Thus, the present alternative water supply will have a maximum daily capacity of from 3,200 to 5,200 gpm. The RAO objective of short-term and long-term plans for alternative water replacement is not static; if additional alternative water supply needs are determined to be required in the future for the WGOU, because of Aerojet contamination, additional supplies will be sought. Also, in the first two years of the remedy implementation, provision has been made to provide 3,400 gpm of additional water through direct discharge to the drinking water system. Until an enforcement agreement is in place to implement the remedy for WGOU, Aerojet's obligations to replace water supplies falls under the current Partial Consent Decree (PCD) for the Remedial Investigation/Feasibility Study. The PCD requires Aerojet to perform a Preliminary and Final Water Supply Alternative Report which are part of the public record. Aerojet has submitted a Preliminary Water Supply Alternative Report Perchlorate - Arden-Cordova Water Service Well #1 dated November 17, 2000 and a Final Water Supply Alternative Report will be submitted 60 days after a Record of Decision for Western Groundwater Operable Unit. On June 19, 2000, Aerojet submitted a Final Revised Preliminary and Final Water Supply

Alternatives Report for Arden Cordova Water Service Wells #11, 13, 15, 16 and 19.

382. For the record, despite the fact that the RI/FS appears to conclude that SCWC's production capacity will be destroyed this year, SCWC refers to the National Remedy Review Board presentation package presented in August regarding future supply predictions. This document states that 3,400 gallons per minute will be provided as replacement drinking water by the year 2023. SCWC already has sustained losses in excess of 3,600 gallons per minute. If SCWC is forced to shut down wells 1, 10 and 20 it will lose an additional 3,675 gallons per minute. Thus, it appears that no provision is being made to replace some 7,300+ gallons per minute the proposals acknowledge will be lost. How is this loss to be addressed?

USEPA Response to Comment #382 - As outlined in Response to Comment #381, approximately 3,200 to 5,200 gpm of maximum daily available capacity is being provided in the present alternative water supply plan and an additional 3,400 gpm of treated water should be available during the first two years of the remedy implementation. See Response to Comment #384.

383. Alternatives B and C do not factor in SCWC's need to pump from wells outside the contaminant plumes at an increased rate to continue to meet water supply needs for its customers. How will SCWC's need to increase pumping be impacted by the alternatives?

USEPA Response to Comment #383 - The current 1,200 gpm capacity and pending additional well capacity tie to Arden Cordova mains should not require increased pumping from outside the contamination area to maintain current capacity. The USEPA acknowledges that if demand increases within the area of the contaminated groundwater, this demand will have to be supplied from sources outside the area of contamination or from the reuse of treated groundwater. If existing Arden Cordova wells are required to reduce their pumping rates to maintain control of the groundwater contamination replacement water will be provided by Aerojet.

384. If the analysis contemplates the permanent loss of Arden Cordova wells 1, 10 and 20 as well as the permanent loss of (other) water, SCWC must be compensated with water, money for infrastructure to treat the replacement water, money to acquire new water sources, and money for the loss of groundwater rights involved. Is fair compensation for SCWC contemplated in either alternative?

USEPA Response to Comment #384 - Compensation for wells already lost by SCWC is not in the Record of Decision (ROD) for the Western Groundwater Operable Unit. The ROD does require Aerojet to provide an alternative water supply, both short- and long-term in the event any more water supply wells are impacted by Aerojet groundwater contamination.

385. The alternatives obviously contemplate that no new production wells will be placed east of the C aquifer OU wells. Moreover, both alternatives 4B and 4C apparently contemplate that SCWC will not be able to add well production to the west of the C aquifer OU wells. This appears to effectively preclude SCWC from developing additional groundwater supplies in its service area. Can SCWC drill new wells or increase production in existing wells to the west of the proposed C aquifer OU wells to meet current customer needs and contemplated growth?

USEPA Response to Comment #385 - New drinking water wells to the west of the layer C off-property containment extraction wells can be installed if they do not have the potential to adversely effect the containment of the groundwater contamination. Treated groundwater extracted from the aquifer under Western Groundwater Operable Unit remediation will either be discharged to surface water or directly to a drinking water system, if such is approved by Department of Health Services.

386. Neither analysis 4B nor 4C provides an adequate discussion of the vertical characteristics of the aquifers or the rationale for the movement of the D level wells at D1, D2, D3 and D4 to the east of the locations proposed in alternative 4B.

USEPA Response to Comment #386 - Volume III Appendix D of the Remedial Investigation/Feasibility Study (RI/FS) discusses vertical water movement for each of remedies. Since the RI/FS, the USEPA used the existing groundwater model to review particle movement between layers C, D and E for alternatives 4B and 4C. The particle movement between layers is shown in the following table.

Alt.	Starting Layer	% Ending in Layer C	% Ending in Layer D	% Ending in Layer E
4B	C	93.0	7.0 down	none
	D	13.1 up	86.9	none
	E	none	34.1 up	65.9
4C	C	93.1	6.7 down	none
	D	16.1 up	82.5	0.9
	E	none	3.9 up	95.3

During design, the extraction well locations will be optimized to prevent groundwater flow between layers. The rationale for the movement of D1 through D4 extraction wells closer to Aerojet in alternative 4C was to 1) prevent further contamination of the D layer, and 2) significantly expedite the cleanup time for layer D over alternative 4B. Also, four additional C layer extraction wells were added adjacent to the D1 through D4 layer wells to reduce the potential for particle movement from the C layer to the D layer.

387. Vertical permeability characteristics of the aquifers and aquitard are not detailed in the alternatives, including the adequacy of model calibration to these parameters. The potential for the pulldown of contaminants from the C level aquifer to the D level aquifer, as a function of the extraction aspect of the proposals, needs to be fully considered. Has it been?

USEPA Response to Comment #387 - Vertical (permeability) hydraulic conductivity is one of many parameters used in developing the groundwater model described in the RI/FS Appendix D of the Remedial Investigation/Feasibility Study. Because there is little or no site-specific data available on vertical hydraulic conductivities for aquifers in the area, the initial values of vertical hydraulic conductivity were estimated. Experience with similar sites indicates that vertical hydraulic conductivity is typically 10 to 100 times lower than the horizontal hydraulic conductivity. The initial vertical hydraulic conductivity were varied in developing the final calibrated model. Sensitivity analysis of the flow model indicates that vertical hydraulic conductivity is one of the least sensitive of the parameters. The groundwater model was developed as a tool for comparing remedial alternatives. The potential for induced downward movement of contaminated groundwater was considered in selecting the groundwater remedy. The final number of extraction wells will be determined during remedial design in the future. See also Response to Comment #386.

388. Neither alternative 4B nor 4C addresses whether or not enough wells are being installed to actually capture all of the contaminant plumes, nor is there an analysis of the adequacy of the production rates specified for those wells. This is particularly true, in both alternatives, with reference to the E level aquifer. (Alternative 4B calls for only one E level well and alternative 4C calls for two E level wells.)

USEPA Response to Comment #388 - The groundwater model was developed to be a tool for comparing remedial alternatives. The selection of the pumping rates and the number and location of the wells were based on the best available information, modeling results and professional judgment. The final configuration of the extraction system will be determined during remedial design phase in the future.

389. Regardless of whether alternative 4B or 4C is adopted, there does not seem to be clear evidence that the westernmost wells will capture all of the contaminants. Certain contaminants have been found in wells west of the westernmost wells recommended in both alternatives 4B and 4C. SCWC has already lost Arden Cordova wells 7 and 12 to contamination from the Aerojet site. BOTH of these wells are WEST of the proposed new extraction wells. What is the evidence that the RI/FS has adequately defined the plumes so their capture is assured?

USEPA Response to Comment #389 - It is not clear where or what contaminants the comment refers to other than Arden Cordova wells #7 and #12. The low level N-Nitrosodimethylamine (NDMA) readings in wells #7 and #12 are at the

extreme range of the detection capability for NDMA and were not confirmed by subsequent sample testing conducted by the Regional Water Quality Control Board. Low level readings of Trichloroethylene and Tetrachloroethene in Arden Cordova well #1 appear to be from a local cleaning establishment.

The extraction well locations in the RI/FS and the proposed plan are only a conceptual design. Ongoing groundwater sampling and analysis of groundwater from wells in the vicinity of the groundwater contamination boundaries provide evidence of groundwater contamination migration. The actual location of the extraction wells will be based on the most current information available during the design phase.

390. Pumping at rates contemplated by the OU may result in impacts to model boundaries that could adversely influence the results the model predicts. Has this very significant issue been evaluated?

USEPA Response to Comment #390: The model domain was designed to cover a large area in order to minimize impacts of the effects of boundary conditions on groundwater extraction.

391. Both alternatives seem to assume that replacement water for SCWC will come from somewhere outside the groundwater system. However, no plan or provision is made for that replacement supply, there is no discussion of how new water rights will be acquired, or funded, or how necessary new infrastructure will be provided and funded. When and how will these issues be addressed?

USEPA Response to Comment #391 - An estimated 3,200 to 5,200 gpm of alternative water supply will be available and be provided as necessary (See Response to Comment #377). Within the first two years of the remedy implementation, an additional 3,400 gpm of treated water will be available if the treated groundwater is directly discharged to the drinking water system.

392. In conclusion, neither the alternative favored by the EPA nor that favored by Aerojet, addresses how the water that SCWC has already lost, or that which it will lose in the future, will be replaced and how the costs incident to those losses will be compensated. It is vital that all the issues of replacement supply, including direct or indirect reuse of treated water, be carefully considered as part of the adopted plan. Given what is now known, SCWC favors indirect reuse where treated groundwater is put into the American River, and thereafter is extracted and treated by SCWC as surface water.

USEPA Response to Comment #392 - Under past settlement agreements with Southern California Water Company (SCWC), Aerojet has installed approximately 5,000 feet of sixteen inch internal diameter piping and appurtenant facilities necessary to interconnect the SCWC water supply system with the City of Folsom water supply system. A 2 million gallon reservoir was added including re-piping. SCWC well #20 was upgraded to increase the capacity of the SCWC's

Colma Facility. Well #22 was constructed and placed in service. These actions are outlined in Aerojet's letter of June 19, 2000 for the Final Revised Preliminary and Final Water Supply Alternative Reports for Arden Cordova Water Service Wells # 11, 13, 15, 16 and 19. The Record of Decision for the Western Groundwater Operable Unit will require Aerojet to provide alternative water supplies in the event water supply wells are contaminated in the future. See also Response to Comment #377 and #380.

393. **Comments Received from County of Sacramento Water District** – The RI/FS indicates that, "The conceptual design of each of the remedial alternatives was based on the results of a numerical groundwater flow model." A review of the model summary of calibration statistics and the scatter plots suggest that the transient model is calibrated and that it may be an appropriate tool to simulate proposed localized contaminant remediation alternatives. But, it does not appear that the model accurately represents the regional American River hydrologic system and may grossly underestimate the regional impact that the contamination has on groundwater resources. For example:

- The groundwater transport model used by Aerojet assumes that the Lower American River "gains" approximately 1,100 AF/year over the 1981 to 1998 simulation sequence (Table D6-2). For the same period, the model assumes stream losses are approximately 5,000 AF/year.

- The loss values reported by Aerojet are inconsistent with other studies that evaluated American River losses. Losses on the American River have been estimated by DWR (Bulletins 118-3 and 104-11), USGS (Professional Paper 1401-D), US Bureau of Reclamation (American River Water Resources Investigation, 1996), and by the City and County of Sacramento (Water Forum, 1999). In the more recent studies the loss rate of the American River is approximately 90 TAF/year.

- Outside the influence of Lake Natoma, groundwater conditions within the last 30 years do not indicate that the American River is "gaining" within the reach of the river encompassed by the study area.

- The model does not include pumping north of the American River. A number of water supply wells located within the boundaries of the model were not included, by not including these wells groundwater levels north of the river will be higher than observed conditions. The higher simulated groundwater levels would also effect the simulated loss rate of the American River.

<u>USEPA Response to Comment #393</u> - The model simulates the American River as a net losing stream. In the reference to Table D6-2, inflow refers to inflow to the model from the river. The net recharge in 1998 to the aquifer from the river is 5,000 acre-ft/year. The model doesn't incorporate the entire length of the American River therefore comparisons with the referenced data may not be useful. Wells to the north of the American River, were not used in the model and

would not significantly impact the study evaluation. The USEPA does not believe the (WGOU) grossly underestimates the regional impact of the Aerojet contamination.

394. The model does not consider the fully exercised groundwater basin or other actions that are reasonably foreseeable. For example:

- Water Forum conjunctive use plans.
- Remediation of the other "outside" sources of perchlorate, NDMA, and VOC contamination. These sources have not been identified in the RI/FS and there is no discussion on how they may be impacted or how they may impact Aerojet's remediation of groundwater contamination.

USEPA Response to Comment #394 - The groundwater model is a very general representation of the groundwater system based on historical information and was calibrated based on response data from wells. The groundwater model does not evaluate sharing of water by water purveyors or future extraction of water on Aerojet property for future source control of Contaminants of Concern. Evaluating these unknown variables was not possible during the model development. It will be some time before the remedy or remedies for the up-gradient source contamination on Aerojet property will be selected.

395. Cleanup and Abatement Order 97-093 indicates that development and implementation of a corrective action for the IRCTS, "will be coordinated, and may be combined, with a similar effort required of Aerojet under Order No. 96-259". The groundwater model developed for the Western Groundwater Operation Unit does not consider what impacts remediation efforts in the IRCTS and Mather areas will have on Aerojet's remediation efforts and vise versa. If these efforts are to be coordinated, as mentioned in Order No. 97-093, remediation on IRCTS and Mather should be considered critical elements to the model.

USEPA Response to Comment #395 - The Western Groundwater Operable Unit (WGOU) model does not evaluate the impact on the aquifer level from remediation at the Inactive Rancho Cordova Test Site (IRCTS). However, the USEPA and Regional Water Quality Control Board are coordinating their efforts to insure that the groundwater contamination from the Aerojet facility and the IRCTS facility are fully contained and remediated.

396. According to the Summary of Feasibility Study in the executive summary, "the FS serves as a mechanism for the development, screening, and detailed evaluation of alternative remedial actions." It is the contention of the County that no real evaluation can occur until the issue of replacement water supplies has been addressed. The RI/FS fails to address this issue and instead focuses on future actions that Aerojet would take if additional well sources were lost due to contamination. The RI/FS should fully address

what actions will be taken by Aerojet to replace water supplies (i.e., capacity) already lost due to groundwater contamination.

USEPA Response to Comment #396 - One of the Remedial Action Objectives (RAO) for the Western Groundwater Operable Unit (WGOU) is "protect public drinking water wells through short-term and long-term contingency plans for alternative water supplies." Presently, Aerojet has a three year agreement with the City of Folsom dated July 3, 2000 for a 3,000 gpm alternative water supply which, under present system restrictions, has a maximum daily capacity of approximately 1,200 gpm. Aerojet is presently installing a new water supply well in Rossmoor Park with an estimated maximum daily capacity of 2,000 to 4,000 gpm. Thus, the present alternative water supply in the near future will have a maximum daily capacity of from 3,200 to 5,200 gpm. The RAO objective with Aerojet is not static and will be augmented as required should additional well loses due to Aerojet contamination occur in the future within the WGOU. In addition, within the first two years of the remedy implementation a provision has been made to provide 3,400 gpm of additional water through direct discharge to the drinking water system or surface water discharge of treated groundwater. Until the remedy for WGOU is implemented, Aerojet is obligated to replace water supplies falls under the current Partial Consent Decree (PCD) for Remedial Investigation/Feasibility Study. The PCD requires AEROJET to perform a Preliminary and Final Water Supply Alternative Report which are part of the public record.

397. The Baseline Risk Assessment (BRA) states that exposure to constituents of potential concern (CoPCs) is assessed by water quality monitoring and that water purveyors, in conjunction with DHS, determine when a water supply well should be taken out of service. This action is considered to be protective of human health. Projects completed to date (i.e., pipelines, interties, and storage) have been interim in nature, and are not a replacement supply. The RI/FS indicates that the various alternatives, "break the pathway through which contaminated groundwater would be supplied for potable use" and are "protective of human health." The County asserts that a threat to human health remains until long-term replacement supplies are provided which are safe, wholesome, and potable. The RI/FS fails to make this assertion.

USEPA Response to Comment #397 - The alternative water supplies outlined in Response to Comment #392 are intended for use as drinking water.

398. Of the nine alternatives considered in the RI/FS only one, Alternative 2A, considers the provision of replacement water supplies. Other "alternative water supply" considerations involve the installation of granulated activated carbon at two wells (AC-14 in Alternative 3A and AC-19 in Alternative 3B) neither of which will remove perchlorate or NDMA. The RI/FS needs to identify replacement water supplies as a component of each alternative.

USEPA Response to Comment #398 - Alternative "Series 3 through 5" have provision for replacement water supplies covered in the Remedial Investigation/Feasibility Study (RI/FS). Specifically, Alternative "Series 3 through 5" include in the RI/FS estimates for a 3,400 gpm surface water treatment plant. Also, the Remedial Action Objective (RAO) discussed in Response to Comment #392 provides for alternative water supplies. In the case of Alternatives 3A and B the treatment system proposed for well AC-14 includes UV/oxidation and ion exchange which will treat for N-Nitrosodimethylamine (NDMA) while the proposed treatment for well AC-19 is ion exchange. Well AC-19 is not in the area of influence of the present NDMA groundwater contamination.

399. The RI/FS presumes that the discharge of large quantities of treated groundwater to the American River and streams tributary to it or the Folsom South Canal will be an acceptable means of disposal. The Baseline Risk Assessment only addresses human exposure and not environmental and aquatic life protections that may be required. The RI/FS should discuss potential environmental and aquatic life impacts resulting from the discharge of treated groundwater to surface impoundments, streams, and the American River and the regulatory approvals and permits that may be required.

USEPA Response to Comment #399 - Any on-site surface water discharge from OU-3, will be protective of aquatic ecosystems and will meet the substantive provisions established under the National Pollution Discharge Elimination System (NPDES) specified in the Record of Decision; off-site surface water discharge will require an NPDES Permit. Any surface water discharge will be protective of human health and aquatic ecosystems.

400. The RI/FS makes reference to the Sacramento County Consultation Zone Ordinance. No such ordinance exists. Sacramento County has proposed that as part of their revision to Chapter 6.28 of Title 6 of the Sacramento County Code that a provision be included that requires a consultation zone be established for applications for a well permit in areas within 2000 feet of a known contaminant plume. The RI/FS should provide a discussion on how human health is to be protected if the proposed ordinance is not pursued.

USEPA Response to Comment #400 - Installation of a drinking water well requires a permit. Sacramento County checks with the Regional Water Quality Control Board on the extent of the plume migration from Aerojet. As part of the institutional controls for the site, Aerojet will be required to annually place a public notice in the local news paper regarding the prohibition of drilling drinking water wells in the area of the Western Groundwater Operable Unit contamination.

401. The RI/FS proposes that, "Incorporation of the management of the treated groundwater into the overall water supply plans for the eastern portion of the County could be used to minimize potential investment by Sacramento County and would delay if not eliminate the need for a new major Sacramento River diversion and accompanying treatment and pumping facilities at least for service to the portions of eastern Sacramento County that

are the farthest from the river. It would allow for staged development of water supply facilities meeting all public health and environmental requirements. All costs above the basic remedial action cost would become part of the new development financing program with potentially significant cost savings to both the remediation and development efforts." RI/FS proposed treated groundwater management scenarios include: direct potable water supply, indirect potable water supply, non-potable water use, streamflow augmentation, and groundwater recharge. The RI/FS should provide greater information on how these proposed management scenarios would be implemented. It should identify the specific mechanisms for implementing the scenarios, identify the regulatory approvals and permits necessary and the potential parties that may object to such proposals, compatibility with regional water supply plans and programs (e.g., the Water Forum), and provide greater detail on timing and implementation. The proposed management scenarios also assume that direct potable water supply is a possibility while DHS has stated on numerous occasions that use of remediated groundwater is unacceptable for potable purposes. The RI/FS also does not indicate if Aerojet is willing to implement any of the proposed management scenarios within their facility, including the direct potable water supply and indirect potable water supply options. The RI/FS should indicate how Aerojet intends to work with the County of Sacramento and other water purveyors to explore the feasibility of their proposal for the management of treated groundwater. These discussions should include the used of remediated water by Aerojet.

USEPA Response to Comment #401 - The Department of Health Services (DHS) by letter of May 3, 2000 to Aerojet states that DHS has not precluded the option of directly discharging the treated groundwater to a drinking water system. The Remedial Investigation/Feasibility Study (RI/FS) appropriately provides the costs for direct discharge to the drinking water system and surface water discharge. The USEPA's November 2000 Proposed Plan provided the options for direct discharge to the drinking water system or surface water discharge of treated groundwater for community comment. Until DHS approves direct discharge to the drinking water system, this alternative cannot be implemented.

402. The RI/FS identify the nine National Contingency Plan (NCP) evaluation criteria under which each of the alternatives will be evaluated. The criteria established in the RI/FS for two of these, State Acceptance and Community Acceptance is of considerable concern to the County. First, State Acceptance entails all technical and administrative concerns that the State may communicate in its comments concerning each alternative. Where is the ability of the County or any other impacted water purveyor to participate in this process? According to this criteria the State in conjunction with Aerojet could make decisions impacting the availability of replacement water supply, use of remediated water, protection of existing supplies and production facilities, the very ability to provide customers with a safe, wholesome, potable water supply without any kind of consultation. Input from the County and other purveyors will be relegated to Community Acceptance where all the decisions have been made and there is simply the opportunity to "review and comment on the selected remedial alternative presented in the Proposed Plan." The RI/FS needs to make provision for greater involvement by the County and other water

purveyors in determining how groundwater contamination will be remediated and how loss of water supply will be addressed.

USEPA Response to Comment #402 - The extended sixty day Public Comment Period and the two public meetings which were held on December 7, 2000 and January 17, 2001 were forums for water purveyor comment. In addition, the Regional Water Quality Control Board provided the water purveyors with copies of draft and final Remedial Investigation/Feasibility Study during the Remedial Investigation/Feasibility Study comment period. All the comments and responses to comments on the Western Groundwater Operable Unit proposed plan received by the USEPA will be part of the public record.

403. In Page 2 of the Executive Summary Aerojet states that offsite sources of TCE and NDMA may be present groundwater flowing "or may be from offsite non-Aerojet sources identified northeast of the intersection of Sunrise and Folsom Boulevards." No specific information is provided to substantiate this statement. What evidence and detailed analysis have been done to substantiate this? Will Aerojet provide detailed analysis to confirm the presence of these additional sources of contamination?

USEPA Response to Comment #403 - The USEPA is not aware of any supporting data that Aerojet is not the source of Nitrosodimethylamine (NDMA) in the Western Groundwater Operable Unit (WGOU). Aerojet has asserted that NDMA appears to be associated with various industrial and food processing industries and has been a contaminant in foods but no specific source locations or responsible parties have been identified by Aerojet. In the case of Trichloroethylene (TCE), Aerojet's July 31, 1998 Preliminary and Final Water Supply Alternatives Report for Arden Cordova Water Service (ACWS) well #1 (Aerojet well #1011) presents data that contamination of ACWS well #1 by Tetrachloroethylene (PCE) and its resulting degradation product TCE was due to dry cleaning operations. Also, Aerojet submitted an April 30, 1999 Final Water Supply Alternative Report for TCE in a private well (Reference State Well #9N/6E-25-L1; Aerojet well #1037; located at 11050 Folsom Blvd, between the intersections of Sunrise Blvd. and Kilgore Rd) in which Aerojet identified four potential TCE sources for the contamination (former plastics manufacturer; former air strip; old sunrise dump; and a truck and equipment rental facility).

However, USEPA analysis of Department of Water Resources (DWR) data indicates that the water table in the WGOU was approximately 82.3 feet above mean sea level in 1962, and that the regional water table fell by 10 to 15 feet a decade between 1962 and 1995. This suggests that the water table was approximately 92 feet above mean sea level in 1952, which is 35 feet above the top of the well screen of well 30065. This suggests that groundwater contaminated with TCE likely also migrated from Aerojet to the vicinity of Sunrise and Folsom Boulevards. Also see the Response to Comment #19.

404. In Page 5 of the Executive Summary the RAO Number 2 is to "Minimize offsite migration of CoPCs where practicable". Who defines and makes the decision on what is practicable?

USEPA Response to Comment #404 - The Agencies,(USEPA, Regional Water Quality Control Board and Department of Toxic Substances Control Board) by joint letter from the Regional Water Quality Control Board dated October 13, 2000 amended the Remedial Investigation/Feasibility Study (RI/FS) Remedial Action Objectives (RAO). The referenced RAO is now "achieve containment of the groundwater contamination to minimize future migration until cleanup is accomplished;". The RAO was also contained in the November 2000 USEPA's Proposed Plan submitted for public comment. The agencies will evaluate "minimize future migration" based on threat to human health and the environment.

405. In Page 5 of the Executive Summary RAO Number 4 is to "Protect public drinking water wells and provide treatment or alternate supply, as appropriate, for those wells that have been or become impacted by CoPCs at unacceptable levels." What does as appropriate mean and what is an unacceptable level? No chemical action level of the chemicals in parts per million ("ppm") or parts per billion ("ppb") has been provided. How soon can the County expect an alternate supply for well #17? This well has been impacted by CoPCs at an unacceptable level, and it is appropriate to replace it. Replacement water supplies should be included as part of all alternatives. Define substitute water supply.

USEPA Response to Comment #405 - The Agencies by joint letter from the Regional Water Quality Control Board dated October 13, 2000 amended the Remedial Investigation/Feasibility Study (RI/FS) Remedial Action Objectives (RAO). The referenced RAO is now "protect public drinking water wells through short-term and long-term contingency plans for alternative water supplies;". The RAO was also contained in the November 2000 USEPA's Proposed Plan submitted for public comment. As outlined in Response to Comment #392,the alternative water supply efforts are to provide short-term replacement water for County of Sacramento well #17 and for other anticipated needs. On June 15, 2000, Aerojet provided the Agencies with a Second Revised Preliminary Water Supply Alternative Report for Sacramento County Well #17. Aerojet will provide a Final Water Supply Alternative Report 60 days after a ROD is issued for the Western Groundwater Operable Unit.

The chemical action level for shutting down a contaminated public supply well is determined by the Department of Health Service.

406. In Page 7 of the Executive Summary, the institutional controls include 1) DHS's enforcement of drinking water regulations requiring water purveyors to take action to monitor and shut down water supply wells that they or DHS consider to be inappropriate for service to customers". What is meant by "supply wells that they or DHS consider to be inappropriate?" What is the definition of "appropriate"? Please quantify in terms of

concentration of CoPCs in ppm or ppb. Currently the term "appropriate" is defined differently among purveyors.

USEPA Response to Comment #406 - The USEPA cannot define the word "inappropriate" in concentration terms. As stated in the submitted comment the word inappropriate is subject to individual water purveyor's interpretation. The definitive limits are the Department of Health Services Action Levels.

407. In Page 8 of the Executive Summary, the modifying criteria, particularly community acceptance, should have a greater influence in modifying the aspects of the preferred alternatives. This is critical since Aerojet suggests the use of remediated water as a potable supply, replacement supply or substitute supply. Aerojet's assumes that communities and purveyors will accept remediated water for potable use. There is no mention in this section, as there are in other sections, to community acceptance of remediated groundwater for potable uses. In Figure 4-1 there is no reference to potable under alternative 4C. Why is this included in this section as a possibility?

USEPA Response to Comment #407 - The Remedial Investigation/Feasibility Study (RI/FS) and the USEPA's November 2000 Proposed Plan submitted for public comment indicates the options for alternative water supplies under Alternatives "Series 3 through 5" are direct discharge to the drinking water system and surface water discharge. Through the extended 60 day comment period and two public meetings the public has been given the opportunity to comment on direct discharge to the drinking water system and surface water discharge of treated groundwater. All comments and USEPA responses to comments on the Western Groundwater Operable Unit proposed plan will be part of the public record.

408. In Page 10 of the Executive Summary it states "...restore the aquifer to beneficial uses and reduce the magnitude of residual risk…" What are beneficial uses? What is the magnitude of the risk that has been reduced? Is the intent to provide this as a potable water source?

USEPA Response to Comment #408 - The primary beneficial use for the aquifer is as a drinking water source. The reduction of the magnitude of the residual risk is such that the aquifer can be used as a source of drinking water.

409. In Page 10 of the Executive Summary it states "...would be expected to provide greater reduction in toxicity, mobility and volume…" What will be done if the results are not what are expected?

USEPA Response to Comment #409 - After the remedy is in place, if it is determined that it is technically impracticable to restore the aquifer or a portion of the aquifer, Aerojet could apply to the USEPA for a Technical Impracticability (TI) Waiver in accordance with USEPA guidance (EPA 540-R-93-080). A TI waiver for a drinking water aquifer would require, at a minimum, containment of the

contamination and monitoring of the groundwater until Remedial Action Objectives are met.

410. In Page 12 of the Executive Summary, was the draw down modeled? Will there be a monitoring program in place to the estimated draw down? How did you determine that any remedial option would not have any significant impact on the aquifer? Was a model run over time to check this assertion? What mitigation measures are being proposed to ensure that this does not affect the aquifer?

USEPA Response to Comment #410 - Draw down modeling data is contained in Volume III, Appendix D of the Remedial Investigation/Feasibility Study. The Record of Decision for the Western Groundwater Operable Unit will require groundwater monitoring. One aspect of the groundwater monitoring will be monitoring groundwater levels.

411. In Page 14 of the Executive Summary, at what point will input from the County be required for the offsite construction issues? Direct reuse should not be considered until approved by DHS.

USEPA Response to Comment #411 - Comments on off-property construction issues should have been provided as part of the public comment period. During Remedial Design, the USEPA will solicit input from the water purveyors on the selection of optimal well locations and piping routes. Direct discharge to the drinking water system of contaminated groundwater for drinking water is not currently implementable because the Department of Health Services has not approved the proposed treatment system.

412. **Written Comments Received from Citizens Utilities Company of California** – General Comment a) Threat to Citizens' Water Supply System From the Aerojet Plume. - The water replacement provisions included in the RI/FS, however, are wholly and completely inadequate. In fact, Alternative 4C, the remedial alternative recommended by the EPA, devotes scant attention to the impact on downgradient supply wells, and includes no specific provision for alternative water supplies. Aerojet in the RI/FS has largely ignored DHS and the requirements it has imposed to protect the drinking water supply. Aerojet must give full consideration to DHS directives in all matters that relate to the drinking water supply.

USEPA Response to Comment #412 - See Response to Comment #396 pertaining to alternative water supplies. Priority will be given to containing the contamination and preventing further movement of the contaminated groundwater downgradient in layers C, D and E. The California Department of Health Services drinking water directives will be followed. See also the Response to Comment #401.

413. General Comment b) Impact of Contamination From IRCTS and Other Areas at Aerojet Site. - The RI/FS strictly limits its scope to the contamination found in OU-3. The

contamination that will have an impact on the soil and groundwater in the Rancho Cordova area and on Citizens' drinking water supply, however, extends well beyond the boundaries of this operable unit. The environmental conditions in this area must be considered as a whole to have any hope of protecting the groundwater and the drinking water supply. In evaluating a number of issues relevant to the RI/FS, including maintaining and adequate supply of drinking water and determining the effect of the extraction wells utilized to remediate contaminated groundwater, the contamination at other locations on the Aerojet property and at the IRCTS must be considered to formulate a plan that is fully protective of the public health and safety.

USEPA Response to Comment #413 - The adjacent contamination on the Inactive Rancho Cordova Test Site (IRCTS) is being addressed by a Regional Water Quality Control Board (RWQCB) Order 97-093 issued July 1, 1997 to McDonnell-Douglas Corporation and Aerojet-General Corporation. Replacement water supplies by parties responsible for the contamination will be provided under the direction of the RWQCB. An Engineering Evaluation and Cost Analysis has been completed for an interim action to contain the contaminated groundwater. The remediation actions required by the Western Groundwater Operable Unit (OU-3) and the IRCTS RWQCB Order, to protect the groundwater and contain the contamination as a whole on the western side of Aerojet and IRCTS are being coordinated by RWQCB and the USEPA. The OU-3 containment effort has two parts, contain the maximum extent of the groundwater contamination off Aerojet property, and modify the existing on-property groundwater containment system to prevent further high concentration contamination from moving off-property. The up-gradient sources of the groundwater contamination on Aerojet's property will be addressed in future operable units.

414. Specific Comment a) The Proposed Mediation Plan May Have a Destructive Effect on the Groundwater Table - Alternative 4C may severely deplete the aquifer, and make it difficult or impossible for the water purveyors to obtain sufficient water from their production wells. The RI/FS, however, fails to evaluate the potential threat to the groundwater that may be presented by the selected remedial system.

USEPA Response to Comment #414 - Draw down modeling data is contained in Volume III, Appendix D of the Remedial Investigation/Feasibility Study (RI/FS). The remedial alternatives presented in the RI/FS were developed to balance the amount of groundwater extraction required to contain and cleanup the contamination with the costs and time required for remediation. Part of this balancing process was the selection of a minimal number of extraction wells, instead of two or more times as many wells to minimize the potential impact on the aquifer. The water extracted from the aquifer for remediation will be available after treatment to the community. Both Alternatives 4B and 4C would also have a similar impact on the aquifer.

415. Specific Comment a)(1) Impact on the American River - Aerojet's model predicts the American River was losing 6,000 acre feet of water per year to groundwater in 1998. Groundwater levels will continue to decline as more water is extracted, treated and discharged to the American River. This situation raises serious questions about the effect the extraction wells will have on the American River: the impact on surface water entitlements; and the overall impacts on the environment.

USEPA Response to Comment #415 - The USEPA agrees that groundwater levels will decline 30 to 35 feet and that extraction costs will increase although not unreasonably. The extracted treated groundwater will be available for use. The treated water can be moved around within the water purveyors system to augment demand and reduce the need to install additional drinking water wells as demand increases. If the extraction wells are not installed to contain the contaminated groundwater, the contamination will continue to move westward with more and more drinking water wells being sampled and removed from service; this will greatly increase the area/volume of the aquifer that will be contaminated and that will be unavailable for future new drinking water wells. As more aquifer is lost to contamination, replacement water may have to be supplied from outside the demand area at higher cost.

416. Specific Comment a)(2) Water Quality - While the water quality in the deeper aquifers in the vicinity of the Aerojet facility appears to be good, there could be a long-term degradation in the water quality as a result of extended pumping of a high volume of water. In fact, the site hydrogeology suggests that leakage is occurring from lay C down to Layers D and E, predicting the migration of contaminants to deeper aquifers. The RI/FS should conduct a full analysis of this issue.

USEPA Response to Comment #416 - See Response to Comment #386 addressing vertical water movement. The Remedial Design effort will provide for evaluation of the optimum extraction well placement to prevent downward migration of contaminants. Alternative 4C has been modified from that presented at the public meetings on December 7, 2000 and January 17, 2001 to add four additional extraction wells in layer C to address downward migration of contaminants.

417. Specific Comment a)(3) Water Level Draw down/Increased Pumping Costs. - The draw down of the water table caused by extraction well pumping will have a marked effect on the costs incurred by Citizens to pump water from its supply wells. As a result of the lowering of the water levels additional pumping will be required to bring the water to the surface. This will generate increased energy cost to lift the water, and may require a complete upgrade of the well's pump, motor and associated equipment. In some cases, in addition to the equipment upgrades, wells may have to be deepened in an effort to maintain historic yields. The RI/FS fails to address whether Aerojet will bear the additional operating costs arising out of the reduction of the water levels.

USEPA Response to Comment #417 - The Remedial Investigation/Feasibility Study (RI/FS) has primarily concurred controlling the contamination to prevent future drinking water wells from being lost. The additional pumping and operating costs by the water purveyors as a result of Aerojet contamination is a matter best handled directly between the water purveyors and Aerojet.

418. Specific Comment a)(4) Reinjection of Water. - Aerojet has failed to explore alternatives the could allow reinjection to alleviate the depletion of the aquifer, while avoiding the risk to the drinking water supply. Reinjection of treated groundwater along the perimeter of the Aerojet property is clearly problematic, in view of concerns that a new contaminant may be discovered in the treated water that was not removed, causing further degradation of the aquifers downgradient from the injection areas. There would be similar opposition to any proposed discharge of treated water into any usable aquifer off-property and downgradient of the Aerojet property. However, it may be possible to reinject the treated groundwater at a safe distance up-gradient from OU-3 on the Aerojet property. The reinjection of the water at this location would tend to flush out existing contaminants and carry them to the extraction wells for removal and treatment, thereby resulting in a decrease in the amount of time necessary for site remediation. The reinjection of the treated effluent also would maintain a more neutral water balance, greatly reducing the potential depletion of the aquifers and resultant threat to the stability of the groundwater supply.

USEPA Response to Comment #418 - The reinjection of contaminated groundwater up-gradient would flush more contamination toward the boundary and increase the required pumping rate to prevent further contamination from moving off-property. The increased pumping to contain the contaminated groundwater would lower the groundwater table even further. It is USEPA's assessment that there would be less adverse impact to the water table by not reinjecting up-gradient. Under alternative 4C, the treated extracted groundwater will be available to the community for reuse.

419. Specific Comment b)(1) The RI/FS Fails to Make Adequate provision for Replacement of Lost Water Supplies/Multiple production Wells have Been Lost to Contamination. The remedial alternative selected by Aerojet fails entirely to include a contingency plan to replace water supplies lost because of contamination from the Aerojet plumes.

USEPA Response to Comment #419 - See Response to Comment #396 pertaining to alternative water supplies. Replacement of lost water supplies will be provided by the short and long-term provision in the Record of Decision for the Western Groundwater Operable Unit.

420. Specific Comment b)(2) The RI/FS Fails to Make Adequate provision for Replacement of Lost Water Supplies/The Aerojet Plume Has Extended Far Beyond the Property Boundaries. - Based on Aerojet's own velocity estimates, the lateral migration of the plume could extend more than seven miles from the source areas, well beyond the plume delineation presented by Aerojet in the RI/FS. Under a worst case scenario, contaminant

releases could have migrated up to nine miles from the site of the release on the Aerojet property. This underscores the urgent need for Aerojet to prepare and implement plans for the replacement of water supply wells impacted by contamination.

USEPA Response to Comment #420 - Comment noted.

421. Specific Comment b)(3) The RI/FS Fails to Make Adequate provision for Replacement of Lost Water Supplies/Aerojet Cannot Rely Upon Water from the American River to Replace Lost Water Supplies. - Aerojet has suggested that extracted treated water placed in the American River would be available to the water purveyors as replacement water supply. Numerous unresolved issues and concerns from regulatory agencies and other interested parties may preclude downstream withdrawals from the American River. Personnel at the Division of Water Rights have indicated that a permit would likely be required before any water could be removed from the American River. Considering that the proposed diversion of water from the American River by the East Bay Municipal Utility District resulted in litigation that continued for fifteen years, it cannot be assumed that a permit would be readily forthcoming. If the GET facilities stopped or suspended operations for any reason Citizens would be precluded from continuing to draw water from the American River. A supply source that is subject to interruption for reasons beyond Citizens' control is not acceptable. Aerojet has not considered whether existing diversion points can be used to supply water to Citizens. In addition, water obtained from the American River must be treated at a surface water treatment facility and distributed to the area of loss. Aerojet cannot rely upon the use of American River water as a replacement source for lost wells until 1) it has ascertained that this approach is feasible, and 2) Aerojet has committed all of the funds necessary to implement this plan.

USEPA Response to Comment #421 - One of the Remedial Action Objectives is protect public drinking water wells through short-term and long-term contingency plans for alternative water supplies. The present short-term contingency plan provides alternative water from Folsom and a new well under construction at Rossmoor Park. In the long term, treated groundwater is proposed for reuse either through direct discharge to the drinking water system and surface water discharge. The water purveyors concerns for a dependable alternative water supply is addressed in the remedy.

422. Specific Comment c) Data From Water Supply Wells is Not Appropriate to Characterize the Vertical and Horizontal Extent of the Plume - Due to limited monitoring wells the RI/FS relies largely upon production wells for monitoring data. Water supply wells will not provide accurate information regarding the impact of the plume because of blending from several aquifers. Aerojet should be required to install a comprehensive series of monitoring wells that draw discrete samples from each of the water bearing zones that may potentially be affected by the Aerojet plume. Citizens anticipates that discrete samples from each representative zone may present a totally different distribution of contaminants both horizontally and vertically.

USEPA Response to Comment #422 - Projection of the extent of contamination were based primarily on monitoring well data.

423. Specific Comment d) The Implementation of Alternative 4C is Speculative. - Aerojet should have taken active steps to identify well sites, and to begin the process to obtain consent to construct the wells and the piping.

USEPA Response to Comment #423 - The Remedial Investigation/Feasibility Study identified feasible alternatives. The Remedial Design for the selected alternative will address precise extraction well locations and pipeline routes.

424. Specific Comment e) Additional information Regarding the Operation of Aerojet's System for Treatment of Perchlorate is Necessary. - The biological perchlorate removal system installed by Aerojet in the past has experienced considerable operational problems as discussed on pages ES-2 and ES-3 of the Executive Summary of the RI/FS. The disposition of the water generated by the extraction wells if they are operated when the treatment plant is off-line; and whether the system is capable of effectively treating the increased volumes of water.

USEPA Response to Comment #424 - The perchlorate biological treatment system has achieved destruction of perchlorate to non-detect concentrations for the past year and a half of continuous operation. The system utilizes individual fluidized bed reactors (FBRs) with 1000 gpm capacity. Aerojet is conducting studies to determine if flows can be increased through the FBRs. The remedy will use an estimated eight to ten FBRS. It is highly unlikely that more than one fluidized bed will be out of service at any anyone time. The projected catastrophic down time to re-seed an FBR is approximately two weeks. In the event one or two units are removed for re-seeding, the extraction rate would be reduced until the FBR can be restored to service.

425. Specific Comment f) Summary of Remedial Investigation - Aerojet claims that there are non-Aerojet sources of contaminants off-property. The RI/FS states that TCE was commonly used by different industries; that perchlorate was a common constituent of fertilizer; and the NDMA was associated with industrial and food processing industries. Aerojet fails to provide specific information to substantiate this position. Aerojet must provide a detailed analysis of 1) the evidence that confirms the existence of the additional sources of contaminants; 2) the actions currently being taken regarding the off-property contamination by regulatory agencies; and 3) the impact the additional sources of contamination may have on plans to remediate the Aerojet plume and replace lost water supplies.

USEPA Response to Comment #425 - The USEPA is not aware of data that supports Aerojet is not the potentially responsible party for N-Nitrosodimethylamine (NDMA) and perchlorate off-property in the Western Groundwater Operable Unit (WGOU). In the case of Trichloroethylene (TCE), Aerojet has provided information discussed in Response to Comment #403.

USEPA analysis of Department of Water Resources data is also discussed in the Response to Comment #403. The State of California has taken action with regard to volatile organic compounds related to the dry cleaning operation impacting Arden Cordova Water Company's well #1 (Aerojet well #1011). It is the USEPA's position that layer C contamination extending from the Aerojet property will be remediated by Aerojet under a Consent Decree or Unilateral Administrative Order implementing the Western Groundwater Operable Unit Record of Decision.

426. Specific Comment g) Summary of Baseline Risk Assessment. - Aerojet's reference to the cancer risk levels in the Executive Summary pages ES-3 and 4 are confusing and serves no useful purpose. Aerojet also states that none of the contaminants of concern have migrated off-site in concentrations that exceed the EPA's acceptable risk range for additional lifetime cancer risks which is not correct.

USEPA Response to Comment #426 - The Executive Summary needs to be taken as part of the more detailed Baseline Risk Assessment contained in Volume II, Appendix B of the Remedial Investigation/Feasibility Study. The Executive Summary on page ES-4 states Layers A and B on-site are not hydraulically connected with Layers A and B off-site and there are no known off-site chemical impacts related to the Aerojet Site in these layers. In summary, the acceptable risk range for carcinogenic effects off-site were exceeded by Nitrosodimethylamine in Layers C and D, and Trichloroethylene in Layer E. Comparison of the calculated risk to the hazard indices indicates that a hazard index of one was exceeded for chloroform, TCE, and perchlorate in Layer C, and perchlorate in Layers D and E. While perchlorate is a carcinogen, the action level is set below the cancer level which is why the hazard index is used.

427. Specific Comment h) Aerojet's Reliance Upon Institutional Controls. - Executive Summary pages ES-7 and 12 references to institutional controls as a means to address the problems created by the plume is highly problematic. Aerojet was obligated in the RI/FS to prepare a plan to remedy the numerous problems created by the off-site migration of the toxic chemicals that it released into the soil and groundwater. To accomplish this objective will require that Aerojet both cleanup the off-site contamination, and also replace lost water supplies. The removal of contaminated wells from production in accordance with DHS directives does not achieve either purpose. The so-called institutional controls do not reduce contaminant mobility, toxicity, or volume. The repeated reference to the closure of supply wells as a consumer safeguard is further evidence of Aerojet's lack of a sincere effort to create a useful RI/FS.

USEPA Response to Comment #427 - One component of the Remedial Investigation/Feasibility Study (RI/FS) is the review of institutional controls (ICs) to augment the remedy for protection of public health. The focus of the remedy is containment of the contamination followed by restoration of the aquifer between the on and off-property extraction wells. The Department of Health Services action levels for removal of a drinking water well from service happens

to be an IC for protection of public health; however, it is an auxiliary safeguard and not the primary focus of the remedy.

428. Specific Comment i) Long-Term Effectiveness and Permanence. - In the Executive Summary page ES-10, Aerojet contends there is no realistic basis for evaluating the extent to which aquifer restoration will occur and over what time period. Aerojet should have been able to provide a reasonably accurate prediction of the movement of the plume, the actions necessary to achieve cleanup, and the period of time necessary to complete this process.

USEPA Response to Comment #428 - Comment noted. In the Remedial Investigation/Feasibility Study (RI/FS), Aerojet provided an estimate of the plume extent in 25 years and the associated cost of alternatives for this 25-year period. To determine the length of the remedy alternatives, the USEPA used the groundwater RI/FS particle tracking model and retardation rate for contaminants of concern to estimate the time frame for remedy completion; this information was used to revise the estimates, which were provided to the community in the proposed plan. The time frames and cost (in total present value) to complete each of the remedy alternatives that were protective of public health were provided to the community in the Proposed Plan submitted for public comment November 2000 and at public meetings held December 7, 2000 and January 17, 2001. Aerojet has commented on the USEPA's efforts*. See USEPA Response to Comments #135 through #151.*

429. Specific Comment j) Short-Term Effectiveness. - On pages ES-11 and ES-12, Aerojet states that the short-term effectiveness of the various remedial alternatives is measured by the protection provided by each during the construction and implementation process. Aerojet then repeats the comment that, under all alternatives, the community is protected from exposure to contamination through DHS drinking water standards. Removal of a well from service because of failure to meet water quality standards does not improve the short-term effectiveness of any remedial alternatives.

USEPA Response to Comment #429 - Until the groundwater is restored for drinking water use, one of the components of the remedy for protection of public health is removal from service of contaminated drinking water wells.

430. Summary - The RI/FS is inadequate in the numerous respects identified in this letter, including the failure to provide alternative to replace lost water sources to contamination; failure to assess the impact of the selected remedial alternative on the groundwater; and failure to provide for adequate characterization of the plume. Aerojet should immediately be required to take steps to remedy the deficiencies and provide an RI/FS that achieves the intended purpose.

USEPA Response to Comment #430 - See Response to Comment #413 for replacement of lost water sources. See Response to Comments #413 through #422 for impact of the selected remedy on groundwater. See Response to

Comment #422 for adequate characterization of the plume. The USEPA and the State of California are negotiating with Aerojet at present to modify the Partial Consent Decree so that the Aerojet Site divided into operable units and remediation of the site can be expedited. The Western Groundwater Operable Unit is the first operable unit under the modified approach.

431. **Written Comments Received from Carmichael Water District**. While it is understood that the three contaminants driving the design of the clean-up plan are perchlorate, NDMA, and TCE (VOCs), the plan must have a program in place that will identify and quantify contamination from other compounds in the treatment discharge.

USEPA Response to Comment #431 - Aerojet submits an annual Groundwater Monitoring Plan to the agencies for review; this plan includes evaluation of practical quantitation level and method detection limit for chemicals of concern; the extent, frequency, and type of any appropriate analysis for tentatively identified compounds; and identification of the current drinking water standards (state and federal maximum contaminant levels). When any tentatively identified compound is found to be present in the latest years sampling data, data will be reviewed to further identify the compound and to determine if a change is needed in the sampling protocols. Where the action level for a chemical of concern is below the current practical quantitation level, a method review will be conducted annually to insure the best detection capability is being used. If on-site surface discharge is selected for the remedy, discharge limits will be in compliance with the substantive provisions of an NPDES permit specified in the ROD; discharge off-site will require an NPDES permit.

432. Contamination characterization must be done with sufficient frequency so as not to place our customers at health risk from drinking contaminated source water. The plan states that dilution and downstream treatment provide reduced risk. However, some current and future chemicals of concern may not be treatable with available treatment technology at water treatment facilities.

USEPA Response to Comment #432 - Comment noted. A sampling plan will be part of the remedy for the operable unit.

433. If additional chemicals of concern arise that were not identified in the proposed plan, they should be addressed immediately and included in revisions to the remediation plan. The discharge should cease until such issues are satisfactorily addressed.

USEPA Response to Comment #433 - Comment noted. If surface water discharge is selected, the discharge will be suspended if contaminates are found that exceed the discharge standard.

434. Any and all discharge of treated water into the American River must meet the California Department of Health Services primary and secondary acceptable drinking water standards. Any dilution of treated water to meet these standards must be done in a

controlled manner prior to discharge into the river, i.e. the plan cannot rely upon the river to perform the dilution process.

USEPA Response to Comment #434 - If surface water discharge is selected, the discharge will meet or be more stringent than the Department of Health Services drinking water standards and the treatment system design will not rely on river dilution to meet the standard.

435. There must be an immediate notification process to our District and other downstream users when and if the discharge exceeds acceptable drinking water standards and any liability due to such discharge must be the responsibility of Aerojet, not downstream water purveyors such as Carmichael Water District, who rely on the American River as a water supply source.

USEPA Response to Comment #435 - Comment noted. If surface water discharge is selected, Aerojet will be required to notify downstream water purveyors that could be adversely affected if any discharge to the river exceeds acceptable drinking water standards.

436. The contaminant treatment facility processes must be validated under all conditions of the normal operation to affect treatment standards. Such validation includes requirements for maintenance to assure treatment objectives.

USEPA Response to Comment #436 - Comment noted. If surface water discharge is selected, the treatment systems will be designed to exceed the normal operating standards including discharge monitoring. Maintenance of the treatment facility will be part of the facility operation plan.

437. The Department of Health Services, through the Office of Drinking Water, must have the immediate and unilateral authority to order cessation of treatment discharge into the American River. The Carmichael Water District is eager to work with all parties to assure implementation of the above conditions for plan acceptance.

USEPA Response to Comment #437 - If surface water discharge is selected, the USEPA and the State will enforce the discharge requirements which will meet or exceed DHS requirements.

438. **Letter from Jim Sequeria, City of Sacramento, Dept. Of Utilities to Charles Berrey (1/25/01)**: The City of Sacramento (City) appreciates the opportunity to provide comments on EPA Region IX's Proposed Plan (Plan) to address groundwater contamination in the western area of the Aerojet site, as described in EPA's November 2000 fact sheet. The City provides water to more than 120,000 customer accounts serving approximately 400,000 people. The City treats surface water at two facilities, the E.A. Fairbairn Water Treatment Plant on the American River, and the Sacramento River Water Treatment Plant just downstream of the confluence of the American and Sacramento Rivers. We are actively involved in protection of the quality of our drinking

water source water, and highly value the American River as an important resource for the entire region for its many beneficial uses. The City strongly opposes the discharge of 10 million gallons per day of treated water unless it can be demonstrated that no detectable levels of contaminant chemicals will be found in the receiving stream, the American River, particularly during low flows (<500 cfs). The City's additional comments are provided below in A through D.

USEPA Response to Comment #438: If there is surface water discharge, Aerojet will be required to test treated groundwater on a weekly basis before it is discharged to surface water. Any surface water discharge will be protective of human health. See also USEPA responses 439 through 449 for responses pertaining to proposed remedy.

A. Constituents of Concern

I . Table 1: Chemicals of Concern in Groundwater, page 7 of Plan

1. Chloroform - The upper end of the range shown for the remedial action objective (.43-100 ppb) is not sufficiently protective of human health. Under the Stage I Disinfectants and Disinfection By-Products Rule, the California (CA) Department of Health Services (DHS) Maximum Contaminant Level (MCL) for Total Trilialomethanes is 80 ppb.

USEPA Response to Comment # 439: Chloroform has been detected in very few wells and should be destroyed by UV oxidation or removed by air stripping, so it is anticipated that chloroform will not be present in treated groundwater at detectable concentrations.

2. Vinyl Chloride - The upper end of the range shown for the remedial action objective (.05-5 ppb) should be 0.5 ppb, which is the CA DHS MCL.

USEPA Response to Comment #440: The discharge limit for vinyl chloride will be set at CADHS MCL. Vinyl chloride has been detected in very few Layer C, D and E wells and volatilizes readily, so it should be destroyed by UV oxidation or removed by air stripping. It is not anticipated that vinyl chloride will be present in treated groundwater.

3. The fixed numbers to be selected by the Record of Decision (ROD) for the Remedial Action Objectives should provide a reliable margin of safety to ensure that all Aerojet discharges are below drinking water MCLs. The Remedial Action Objectives should be reviewed and modified in the future as needed. Treatment should be provided with consideration of California Public Health Goals (PHGs) or absent state goals, federal MCLGs for current and any future chemicals of concern. New treatment technologies for the Aerojet site should be evaluated and utilized if it is determined that

they achieve better pollutant reduction and reduce risk. Due to the extremely long duration of the proposed clean-up of 240 years, it is important that reevaluations occur on a reasonable frequency to ensure that all environmental problems are being adequately addressed with the most appropriate available technology.

USEPA Response to Comment #441: The numerical cleanup levels set in the ROD will establish the levels that must be achieved in the aquifer, not the levels to which groundwater must be treated before discharge. For example, if 4 ppb is the aquifer cleanup level for perchlorate, then groundwater with higher concentrations must be contained (limited from spreading beyond the groundwater extraction wells) and extracted until the concentration in the aquifer is less than 4 ppb. Once extracted the groundwater must be treated so that concentrations of all chemical compounds and water quality parameters of the treated groundwater will meet either drinking water standards, if directly discharged to a drinking water system, or effluent and receiving water limits if discharged to surface water.

d. There is no indication of what chemical concentrations are expected in Buffalo Creek and the American River as a result of the 7,000 gpm discharge - particularly during low receiving water flows.

USEPA Response to Comment #442: It is anticipated that chemical concentrations in surface water will be non-detect when treated groundwater is discharged to surface water. Also see the responses to Comments #438, 439, and 440.

2. EPA's July 19, 2000 Aerojet Superfund mailing included a section entitled "Threats and Contaminants". Several metals are listed as soil contaminants on-site, including chromium. Have these chemicals been detected in the groundwater? Has an evaluation been conducted on the potential migration of these metals into the groundwater and the need for treatment? What are the plans for treatment if these metals are present or contingency plans if they are detected in the future?

USEPA Response to Comment #443: Chromium and other metals were not present at concentrations above Maximum Contaminant Levels or the Region IX Preliminary Remediation Goals in groundwater samples collected from wells in the Western Groundwater Operable Unit. See the Response to Comments #238-242 regarding analyses (including metals) performed for groundwater samples collected hydraulically downgradient of source areas, in peripheral areas, and on the western property boundary.

The presence of metals in groundwater is a concern for the operation of a groundwater treatment plant because some metals create scale in pipes and

treatment units; over time, scale (deposits) can clog these pipes and treatment units. Piping and treatment units will be checked to ensure that scale is not forming. If scaling observed, analyses for metals and constituents like carbonates will be performed and the treatment system will be modified as necessary. If metals are detected above discharge limits, the treatment system will be modified to include treatment of metals.

3. The Plan should include a contingency plan if problems arise such as detects above levels approved by the Regional Water Quality Control Board or CA DHS. If additional chemicals of concern arise that were not identified, they should be addressed immediately and included in revisions to the remediation plan. Contingencies should be in place to cease discharge until such issues are satisfactorily addressed.

<u>USEPA Response to Comment #444:</u> In the Consent Decree or Unilateral Administrative Order implementing the remedy, Aerojet will be required to have an action plan to address detections of chemicals in groundwater samples collected from monitor wells installed to monitor containment. Aerojet will also be required to modify their surface water discharge if chemicals are detected in treated groundwater. If additional chemicals of concern (COCs) are detected, the Record of Decision may be modified to include additional COCs.

B. Monitoring Program

1. Monitoring should include the receiving waters, including the American River upstream and downstream of Buffalo Creek. The frequency of the monitoring program should be sufficient to reduce risk to the receiving waters and its beneficial uses, including increasing monitoring frequency when there are substantial reductions in river flow. Detection limits, methods, constituents or other factors should be appropriate to ensure that collected data provides appropriate information to protect human health and aquatic life. These parameters should be adjusted to keep current with future water quality standards and guidelines and available laboratory technology. The monitoring program should include an expanded list of all potential chemicals of concern on a reasonable frequency to ensure that if present at levels of concern, additional chemicals of concern are identified and addressed.

<u>USEPA Response to Comment #445:</u> The Consent Decree or Unilateral Administrative Order implementing the remedy will specify the monitoring requirements for the receiving waters. The Record of Decision will specify the discharge limits for chemicals of concern; these discharge limits will be protective of human health and aquatic life. The Record of Decision will have a provision for review of the remedy to insure it is protective of human health and the environment.

2. The Plan should include notification procedures to contact downstream water purveyors when monitoring results exceed MCLs, detects are found in the American River, or any significant problems with the discharge or remediation activities that affect American River water quality are noted. The discharge should also be immediately ceased. This is essential to ensure protection of public health.

USEPA Response to Comment #446: If surface water discharge is selected as the reuse option, Aerojet will be required to notify downstream water purveyors that could be adversely affected by any discharge that exceeds drinking water standards. If chemicals are detected in treated groundwater above discharge standards, the discharge will be terminated.

3. The Plan should include ongoing monitoring, inspections, and evaluation of site conditions, including the physical equipment utilized for the clean-up to ensure that it is functioning correctly.

USEPA Response to Comment #447: Comment noted. The Consent Decree or Unilateral Administrative Order implementing the remedy will include provisions for groundwater monitoring, inspection of monitor wells, inspection of extraction wells, pumps and piping, and inspection of treatment plant equipment.

C. Residual Contaminants

The Plan includes statements on pages 5 (see second paragraph of inset box) and 12 (see first sentence of page) that there is reduced risk for the preferred alternative 4C because the water would be treated before use by consumers (it is stated in the Plan that dilution and downstream treatment provide reduced risk). However, some current and future chemicals of concern may not be treatable with available treatment technology at water treatment facilities. The Plan should ensure that there are no residual contaminants above acceptable levels.

USEPA Response to Comment #448: Aerojet will be required to treat groundwater to reduce chemicals of concern to protect human health. If the treated groundwater will be discharged to a drinking water system, it must comply with CADHS requirements. If the treated groundwater is discharged to surface water on-site it must comply with the substantive requirements of an NPDES permit; discharge off-site will require an NPDES Permit. See also USEPA response to comments 317 and 445.

D. Water Rights

Has an analysis been conducted of water rights and how the proposed diversion from the Folsom South Canal affects other water diverters? The Plan needs to consider water rights for American River water, and identify the amount of water planned for diversion. (See Plan, page 5, inset box, 2nd paragraph. "The cost estimate for this option includes new piping from the Folsom South Canal to a

new surface water treatment plant that would supply the water purveyors' systems, replacing lost water supplies.")

USEPA Response to Comment #449: The analysis and assignment of water rights is not part of the proposed plan or the Record of Decision. Water rights will be determined in accordance with state law.

5. The City of Sacramento opposes any additional diversions from the Folsom South Canal. Replacement water for affected water purveyors from the Folsom South Canal is not consistent with the Water Forum Agreement.

USEPA Response to Comment #450: At this time, surface water discharge has not been selected, and diversion of water from the Folsom South Canal is only one option that is being considered. Any additional water rights created by the OU-3 treatment discharge would be determined in accordance with state law.

451. **Email from Robert J. Mcgarvey to Charles Berrey (1/29/01)**: My wife and I have been homeowners in Rancho Cordova since 1967. We have seen many changes in our community that have affected us and our quality of life. Rancho Cordova was the most rapidly growing community in Sacramento County in the 50s, 60s and 70s. The development slowed in the 80s, but we are moving forward again today. We believe that the new growth can be much more negatively affected if Alternative 4C is adopted by the USEPA than if Alternative 4B is chosen. Both will stop the groundwater contamination plume. Speaking only as a citizen of Rancho Cordova I support Alternative 4B.

I am very active in my community as a member and past President of the Cordova Community Council, member of the Rancho Cordova Chamber of Commerce, the Cordova Community Planning Advisory Council, Mather Restoration Advisory Board, other boards and councils, and an active member of my church. I speak to quite a few people, and water is a concern for many. As part of Rancho Cordova Aerojet is also concerned about our water. The sooner they can treat the contamination the better off we will be.

Adopting Alternative 4B is the best choice for Rancho Cordova, and the USEPA should move forward with it. Thank you.

USEPA Response to Comment #451: Contaminated groundwater will actually be extracted and treated more efficiently in alternative 4C than in alternative 4B because the extraction wells will be placed near the current maximum extent of the contaminant plumes, instead of waiting for the contamination to migrate to an outer ring of extraction wells and contaminate areas that currently have clean water. In addition, because alternative 4B is estimated to take 108 years longer than alternative 4C, it would likely be necessary to dig up and replace piping several additional times; this will result in more disruption to the community.

452. **Email from Jane Daly (Branch Manager, First Bank and Trust, Rancho Cordova Office and Rancho Cordova Chamber Board Member) to Charles Berrey (1/29/01)**: On behalf of the Rancho Cordova Chamber of Commerce, I would like to express my support for Alternative 4B for the appropriate groundwater treatment alternative for Aerojet. This alternative makes the most sense for the community of Rancho Cordova as a whole. Thank you for your consideration.

USEPA Response to Comment #452: Comment noted. See Response to Comment #451.

453. **Email from Michael R. Gallagher to Charles Berrey (1/26/01):** After reviewing various options, I believe option 4B offers the best balance of cost and effectiveness and should be the one selected.

USEPA Response to Comment #453: Comment noted. See Response to Comment #451.

454. **Letter from Janis Heple, Ecos Board Member:** Thank you for your efforts and involvement with the two community meetings in Rancho Cordova in the past two months. I believe it was valuable having more than one meeting, and I know that it meant more work for a great many people involved with this project.

I am writing in order to provide input from the Environmental Council of Sacramento (ECOS). ECOS has followed the progress on the site for many years now, and has previously made comments on the RCRA clean-up also in progress.

We acknowledge that the Aerojet-General Corporation site is a hazardous waste site with a relatively short yet complex history. The issue of reinjection is an especially sensitive issue, given the history of reinjection on the site in the late 80's and early 90's. Given the potential options, and the issues as discussed in your fact sheets and during the community meetings, ECOS would like to go on record as supporting Option 4C.

Thank you very much for this opportunity to comment.

USEPA Response to Comment #454: Your comment will be part of the public record.

455. **Letter from Jeanne Dunkinson:** I am writing to provide my support for the western groundwater remedy alternative 4B, rather than 4C. As I understand, both 4B and 4C will stop the plume of contamination and clean the groundwater of concern. However, 4B will do so in a manner that is much less disruptive to the community.

As a resident of Rancho Cordova, I would like my support of 4B to be placed on record with your agency.

USEPA Response to Comment #455: Comment noted. Because it will take an additional 108 years to clean up the groundwater contamination if Alternative 4B is chosen, it is likely that it will be necessary to dig up the piping to repair it or replace it two or more additional times; this will result in more disruption to the community.

456. **Email from Terry Cochran:** As a member of the Folsom community and the Los Rios Community College Board of Trustees, I urge your favorable consideration of Alternative 4B.

This Alternative can be implemented faster, easier and more cost effectively, allowing Aerojet to start treating the contamination sooner than 4C would allow.

Further, 4C would result in a significant disruption of community transportation.

The science and technology are exactly the same, so why not? Please take the common sense approach, one that fully considers ALL the interests of the community into consideration!

USEPA Response to Comment #456: The science and technology are not the same for these two alternatives. The remedy for Alternative 4C will be completely implemented 20 years before portions of the Alternative 4B remedy will be implemented. In addition, in Alternative 4B, the contaminant plumes are allowed to continue to migrate; this means that portions of the aquifer that are currently clean will be contaminated. More time will then be required to clean up this additional contamination. Because it will take an additional 108 years to clean up the groundwater contamination if Alternative 4B is chosen, it is likely that it will br necessary to dig up the piping to repair it or replace it two or more additional times; this will result in more disruption to the community.

457. **Email from Nora Kostelnik**: Please make my support of this plan public record, so that it will count as one of the many community voices in the negotiation stages of convincing Aerojet that the majority of citizens prefer the EPA's plan "C" over their plan "B".

USEPA Response to Comment #457: Your comment will be part of the public record.

458. **Email From David And Julie De Bevoise**: Read and agree with EPA plan that would install several new ground-water extraction wells off the Aerojet Property. Property owner in RC since 1970 and customer of Arden-Cordova Water Service since that date. We have followed progress and lack of progress re this contamination. Aware that some Arden Cordova wells were shutdown and threat to additional wells disturbs us greatly. We urge EPA to proceed ASAP.

USEPA Response to Comment #458. Support for Alternative 4C noted.

459. **Comment from Marla Arnold (Form from 1/17/01 Meeting):** It appears to me that you are only going to clean the new-water entering the top water table and not attacking the pollution - which I have been told is heavier than water and that is why it will take so long to do the clean up.

That nothing is being done to stop unpolluted water from entering the contaminated area nor is any walls being form to keep it from spread sideways while pulling up and cleaning the top water and without going after the pollution it will continue to affect the lower water tables.

Please the proposed plan is similar to that proposed back in the 80's because it doesn't go far enough.

<u>USEPA Response to Comment #459:</u> Groundwater from Layers C, D, and E will be extracted and treated. The contamination in the A and B layers in the Western Groundwater Operable Unit (WGOU) is minimal and of limited extent. The primary reason that the contamination will take so long to clean up is because the groundwater contamination extends over very large areas of the aquifer. For example, when the WGOU Remedial Investigation/Feasibility Study was written, approximately 9 square miles of Layer C were contaminated; it takes time to pump contaminated groundwater out of a 9 square mile area without adversely impacting the aquifer. Also, see the Response to Comments #169-170.

It is true that rainwater will percolate through contaminated source areas up-gradient of the WGOU, but the inner ring of extraction wells, located near the western boundary of the Aerojet site, is designed to stop this contaminated groundwater from leaving the Aerojet property. In order to expedite cleanup of areas where the risk to residents is the greatest, the WGOU was selected as the first operable unit to be studied and remediated. The risk to residents from contaminated source areas on site is likely to be minimal, so cleanup of these areas will occur at a later date; remediation of contaminated source areas will be addressed in future operable units.

460. **Email From Hptcws to Charles Berrey** (12/5/00): HPT Research, Inc. (HPT), a research and development firm incorporated in 1996 that specializes in technology devoted to water pollution remediation, has successfully bench-tested perchlorate-contaminated water samples from Aerojet. In January 1998, utilizing newly patented and innovative technology invented by HPT, we tested treated and untreated samples, provided by Aerojet, with a series of HPT-patented processes. The HPT-treated samples were returned to Larry Bozach of Aerojet for testing as to any residual perchlorate remaining in the samples after HPT's treatment.

In subsequent telephone conversations with Mr. Bozach, it was confirmed that the HPT processes substantially reduced perchlorate contamination in the Aerojet-provided treated and untreated samples. He informed us that one of the HPT treatments resulted in a 50%

reduction (10 ppb to 5 ppb) of perchlorate. Although we were promised copies of the Aerojet testing results of our treatments; they were never provided. We believe that running the perchlorate-contaminated water through a series of our treatments would reduce the contamination substantially more. HPT's initial testing was very limited due to the small samples provided and the fact that we were essentially "flying blind" on the initial runs. While HPT was encouraged by Aerojet's preliminary positive reactions to the test results, we were quite disappointed in the total lack of subsequent follow-up, despite our repeated contact efforts. We were ultimately told that they had selected an alternate option for treating the contamination and were no longer interested in our technology.

HPT's systems have many applications, ranging from Acid Mine Drainage (AMD) to Selenium removal to hydrocarbon and MTBE remediation to destruction of numerous organic compounds. This patented ionic state modification process has the ability to destroy molecular bonds in a manner that converts them to an insoluble state or renders them non-hazardous.

While our initial testing of Aerojet samples was short-circuited by the company's decision to apply other technologies, HPT has experienced successful on-site and bench-scale demonstrations at or from such locations as Mammoth Mine in Shasta County (AMD), Wantz Equipment in West Sacramento (Hydrocarbons & MTBE), Pinoche Water District (Selenium removal), and Leviathan Mine in Alpine County (Bench-tested AMD). Keven Mayer, Superfund Project Manager EPA Region 9, is familiar with our technology and has referred it to the Army Corps of Engineers for inclusion in their new technology evaluations at Leviathan next Spring.

We at HPT are unequivocally convinced that we have the technology to substantially contribute to EPA's treatment of the perchlorate contamination plume. In fact, one of the contaminated wells outside Aerojet is located across the parking lot from our Rancho Cordova manufacturing location. A site demonstration of our remediation technology could be facilitated almost immediately if EPA is so interested. Please contact Tim Hoel, HPT Director and Manufacturing General Manager, or David Milton, Executive Vice President.

<u>USEPA Response to Comment #460:</u> A provision for incorporation of innovative technologies has been made in the Record of Decision. If this innovative technology is proven more effective than the selected technologies, it could be implemented at a later date.

461. **Email From Caroline Stevens to Don Hodge** (12/12/00): My name is Caroline Stevens and I have lived in Gold River, (across the road from Aerojet) since 1992. I would like to learn more about the leak of perchlorate into the Arden-Cordova Water service wells. According to the Sacramento Bee, dated December 10, 2000 this chemical began leaking in the mid-80s into our water but was not detected until early 1997. As a consumer, I do not recall the water district notifying me of this. Was this the only dangerous chemical that was leaked into our water? Also, is it possible to identify who in the district had the

contaminated water once the technology enabled the water district to detect it? Also, is it safe now? Thanks for your help.

<u>USEPA Response to Comment #461</u>: The California Department of Health services (CADHS) did a Health Consultation for Perchlorate Contamination in the Arden Cordova Water Service Area dated 4/21/98 Aerojet General Corporation Rancho Cordova, Sacramento County, CA CERCLIS #CAD980358832. The report can be obtained from Environmental Health Investigations Branch of the CA DHS at 1515 Clay St., Suite 1700, Oakland, CA 94612 or you can call (510)622-4500. The current CA DHS personnel assigned to the Aerojet Site are Judy Lewis and Greg Braun who can be reached at the number above. Also, see the Response to Comments #276-281.

Prior to late 1997, the perchlorate practical quantitation limit (PQL = repeatable detection capability) was 400 ppb (parts per billion) and no perchlorate was detected off Aerojet property as part of the superfund site monitoring. In 1997, the Division of Drinking Water and Environmental Management of the CA DHS improved the detection capability for perchlorate to 4 ppb (the low end of the USEPA risk range). With the improved detection capability, perchlorate was found in some drinking water wells above 18 ppb state action level and these wells were then removed from service.

With regard to N-Nitrosodimethylamine (NDMA), the detection capability for NDMA was improved by Aerojet from 150 ppt (parts per trillion) to 20 ppt in 1998 which resulted in three wells being removed from service.

Water purveyors annually issue a list of any chemicals in the water supply; it usually comes once a year with a water bill. The drinking water wells are sampled monthly and monitoring wells up-gradient of these wells are also monitored. When contamination is found at the state action levels, the drinking water well is removed from service. When a drinking water well has been taken out of service, the exposure pathway has been removed. The state action levels are generally set lower than drinking water standards (MCLs) to keep the water supply safe.

Water is pumped from the ground, it is placed in the water purveyor's system which results in mixing of the supply. USEPA does not know if any water purveyor will be able to identify specific service connections that may have received water before a well was removed from service.

462. **Email From Larry Ladd to Don Hodge**: I have just received a final copy of the Health Consultation for perchlorate in the Arden Cordova Water Service Area, and I notice with great concern that the data identifying a female cancer cluster in the census tract of Rancho Cordova with greater than 99% statistical confidence is no longer in the report. The CERCLIS number for said document is CAD980358832. It was this cluster that prompted the discovery of nitrosodimethylamine (NDMA) in Rancho Cordova's drinking

water. Be prepared to discuss this disturbing omission at the January 17 hearing. I also would like to know when the Aerojet Health Assessment Site Team will begin deliberating on a Health Consultation for nitrosodimethylamine in the Arden Cordova Water. There is ample evidence in the high NDMA-census tract of damage to genes vulnerable to NDMA via imprinting (IGF2, GNAS1, H19, IPW).

USEPA Response to Comment #462: The CAD document referenced was developed by CADHS and is separate from the proposed plan discussion. Comments on the CADHS risk study should be directed to that agency. The proposed plan was based on the risk assessment in the RI/FS which determined that groundwater remediation is necessary.

463. **Email from Caroline Stevens to Charles Berrey** (12/14/00): I have one other question for you. I would like to know if any hydrocarbon solvents were released into the Arden Cordova water system, at what levels, and during what time period. If this is the case could you please let me know what is considered a safe amount (if any) of these solvents in the drinking water.

USEPA Response to Comment #463: Trichloroethylene (TCE) threatened three Arden Cordova drinking water wells in the late 80s. Carbon filters were placed on the Arden Cordova wells that had TCE to remove the TCE to meet drinking water standards. The USEPA Maximum Contaminant Level for drinking water for TCE is 5 parts per billion. These wells were later removed from service during 1997 through 1999 when monitoring showed contamination by perchlorate and or NDMA. The USEPA Maximum Contaminant Level for drinking water for TCE is 5 parts per billion.

464. Contaminants which damage our lives and health DO NOT recognize political or ownership boundaries, so I ask that the Federal Government should not try to bind these poisons to map boundaries – but follow their actual extent. Do not allow any construction on any property owned by Aerojet because we do not know with scientific certainty the extent and nature of the poisons and dangers.

Please cause independent testing of soil and water to happen east, north, and south of Aerojet.

USEPA Response to Comment #464: See the responses to Comments #308 and #259-262.

465. **Email from Larry Ladd to Charles Berrey (forwarded by Edward Urbansky) Subj: For the Public Record on the Aerojet Rancho Cordova Cleanup** (1/13/01): The cleanup plan you have proposed addresses Rita Lavelle's perchlorate, but ignores Bill Raborn's. I strongly urge you to use the best detection technology possible (<1 ppb) to define the Aerojet perchlorate plume before you begin to finalize the cleanup plan.

<u>USEPA Response to Comment #465:</u> This proposed plan and Record of Decision only address contamination in the Western Groundwater Operable Unit (WGOU). Groundwater contamination to the west of the IRCTS and south of the WGOU is being addressed under Regional Water Quality Control Board (RWQCB) order #97-093. Groundwater contamination north of the American River, north of the WGOU, is being addressed under RWQCB order #96-234. Groundwater contamination in other areas surrounding Aerojet will be addressed in the Perimeter Groundwater Operable Unit.

466. **Email from Linda Budge to Charles Berrey** (1/30/01): In 1979, Aerojet General discovered that waste disposal methods of previous years had moved through the aquifer and contaminated drinking water around their plant. Jack Heckel, who was company President at that time, immediately called together a group of several dozen leading citizens to inform them of the situation and let them know that Aerojet intended to inform them about the problem. That group of citizens included the County Supervisor, County Executive, industry and labor leaders, the Rancho Cordova Chamber of Commerce, the Planning Advisory Council, and public safety officials, to name a few. It was my privilege to be a part of that group.

The solution that is being proposed today to address the additional problems that they and the community face is presented by Aerojet in that same spirit of disclosure and concern. I am, therefore, writing to you personally to support the plan labeled 4B which is being proposed by Aerojet.

Citizens are concerned about the long term health of the community, and it is important to acknowledge that 4B offers many advantages to addressing their concerns. It can be implemented more quickly, more simply, and with a minimum of disruption to the fabric of the community than any other solution proposed. 4B is more cost effective and allows the process of treatment to being much sooner than any other solution proposed.

It is important to understand that this community is not like others you might have dealt with. Although home to 75,000 residents, it is an unincorporated community. It is not a City with City powers and a public works department. It is, however, also home to 60,000 people who come to work here each day, but don't live here. Transportation and the process of getting around on local streets are very important aspects of community life. We are about to spend the next two and a half years with several major transportation projects. Aerojet's solution 4B, to its credit, causes the minimum amount of disruption, especially in the context of other construction projects for the area.

Again I urge you to facilitate the approval of 4B as a method of creating an immediate and effective solution, on a cost effective basis, with a minimum amount of disruption.

<u>USEPA Response to Comment #466:</u> It is unlikely that it will take 2.5 years to install the piping for either Alternative 4B or 4C. Further, because Alternative 4B will take 108 years longer than Alternative 4C to cleanup the aquifer, it is likely

that it will be necessary to dig up the piping and replace or repair it several more times if Alternative 4B is implemented.

467. **Letter from G. Alan Hunter, Rancho Cordova Chamber of Commerce to Charles Berrey** (1/24/01): Representing over 750 member businesses, the Rancho Cordova chamber of Commerce takes an active stand on the issues impacting our community and members. The Chamber offers our public comment on USEPA's preferred alternative for the remediation of the Western Groundwater Operable Unit. The Chamber endorses Alternative 4B over the USEPA's preferred choice of Alternative 4C.

Aerojet recently hosted our chamber board of Directors to a tour of their groundwater biological treatment facility. It is our understanding that the EPA's estimate of 240 years to achieve cleanup in Alternative 4C establishes this level only for the comparison of the other proposed Alternatives based on the current level of technology. It is evident that Aerojet is on the leading edge in the development and application of technologies that will quickly clean the contamination and provide safe, clean water. Aerojet has proven its ability, as evidenced by their development of this first of its kind facility, achieved within two years of the order to remediate Perchlorate and NDMA.

Alternative 4B provides the least disruptive solution for the Rancho Cordova community while preventing the spread of the groundwater plume, cleaning the water, and protecting human health and the local environment. The impacts on the community by implementing Alternative 4C is extremely important in light of current transportation improvement projects planned in the area over the next three years. More than thirty transportation improvement projects are scheduled to take place in the main travel corridors of this community during this time period. The additional two and one-half miles of extra piping required by 4C will severely impact commuter traffic for the more than 70,000 employees that commute to jobs in Rancho Cordova during this heavy construction period.

Since both alternatives stop the contaminant plume, provide safe, clean water and enjoy the approval of the State of California, we believe the determining factor to be the impact of implementation on the local community. It is apparent Alternative 4C will have the greatest disruptive influence on the residential and business community. Therefore, the Rancho Cordova Chamber of Commerce endorses Alternative 4B.

USEPA Response to Comment #467: Both Alternative 4B and Alternative 4C allow for the implementation of innovative technologies that could reduce the cleanup time. These innovative technologies would likely be most effective in treating the higher contaminant concentrations that are located closer to the Aerojet site boundary and in areas where the Alternative 4C interior plume wells will be installed. This would enhance the effectiveness of Alternative 4C and may not require installation of that additional wells that would definitely be required to implement an innovative technology for Alternative 4B. Also see the Response to Comment #86. See the Response to Comment #466 regarding the

potential disruption during construction and repair/replacement of underground piping.

468. **Memo from Ron Suter of Sacramento County Dept. Of Regional Parks, Recreation and Open Space (2/1/01):** I am asking that you consider this request to fund construction of a reservoir and water distribution system to receive reclaimed water from the Aerojet Superfund Site at Mather, California. This request would include a distribution system to move the water from the treatment facility to Mather Golf Course as well as an irrigation system to spread the water throughout the 169.65 acres of the golf course.

Background: The Department of Regional Parks, Recreation and Open Space acquired Mather Golf course and 1400-acre Regional Park in 1994 from the United States Air Force. Since that time, various environmental issues have been identified that include clean up of the property. Contaminated ground water is currently being treated at Mather, on site. It is our understanding that this process will be expanded in the near future and that the availability of remediated water will increase dramatically. Currently, irrigation water for the golf course and park is drawn directly from deep wells.

Proposal: We understand that the proposed work plan for the Aerojet Superfund Site is to discharge the treated water directly into the nearby creek. Our proposal is to use this water on the golf course in exchange for funding the construction of an irrigation storage lake (reservoir), pump station, and irrigation system. The reclaimed water would be pumped directly into the proposed new golf course reservoir (between holes 10, 12 and 18). From there, it would be pumped into the new golf course irrigation system. Any excess water could be diverted to Mather Lake or directly into the creek.

Justification and Benefits: There would be several benefits to this proposal.

- The majority of the treated water would be used for irrigation purposes instead of being discharged directly into the nearby creek.
- The golf course would act as a natural filter for the reclaimed water before it is reused or discharged into the creek.
- The wells at the golf course would be used only to supplement the treated water, thus reducing the draw on the water table by perhaps as much as 200-300 acre feet per year.
- It would provide an excellent opportunity for positive public relations.

Conclusion: As with most government agencies, we are always trying to find better ways to conduct our business. This is one of those rare occasions where both entities involved can benefit from working together. Our golf course would benefit from being able to use the reclaimed water instead of depleting the wells and the water table while adding a water feature to the golf course. The EPA would benefit from putting this reclaimed water to good use in a public facility rather than discharging it directly into the local creek.

USEPA Response to Comment #468: Right to the water being extracted and treated by Aerojet will be determined in accordance with state law.

469. **Letter from the Sacramento County Sheriff's Department, Lou Blanas, Sheriff** (1/26/01): I am writing to you in regard to the Aerojet Superfund Site to express my support for Alternative 4B for the remediation of the Western Groundwater Operable Unit. The EPA has accepted two alternative plans identified as Alternative 4B and Alternative 4C. In reviewing both, it is clear that Alternative 4B poses the least impact on public safety in regard to traffic disruptions and their impact on emergency vehicle response.

Alternative 4B is less disruptive to the roadways in the Rancho Cordova area and can be accomplished in a shorter period of time. The State of California has approved both alternatives in stopping the contaminant plume and providing safe, clean water. During the time that this project will take place there are also other transportation projects taking place in the area that will add to the disruption. This disruption to the community and limiting emergency vehicle access in the impacted area must be taken into consideration.

Transportation and mobility concerns for he public and emergency response providers necessitate the use of Alternative 4B. It is for these reasons and the fact that the State of California endorses both alternatives that I support Alternative 4B.

USEPA Response to Comment #469: Because Alternative 4B will take 108 years longer than Alternative 4C to cleanup the aquifer, it is likely that it will be necessary to dig up the piping and replace or repair it several more times if Alternative 4B is implemented. This would represent a continuing source of disruption. It should also be noted that the implementation of either alternative would require minimizing the impact on emergency vehicle access.

470. **Letter from the Folsom Rancho Cordova El Dorado Transportation Management Association, Rebecca Garrison** (1/27/2001): The Folsom Rancho Cordova El Dorado Transportation Management Association (FRED TMA) appreciates the opportunity to publicly comment on the U.S. EPA's preferred alternative for the remediation of the Western Groundwater Operable Unit. The TMA represents more than 100 employers along the Highway 50 Corridor and advocates for improved mobility, accessibility and air quality along the corridor.

The FRED TMA prefers Alternative 4B to the USEPA's preferred choice of Alternative 4C.

Alternative 4B will provide the least disruptive solution for the 50 Corridor while preventing the spread of the groundwater plume and protecting human health and the local environment. The short-term impact of implementation of Alternative 4C is especially significant in light of current transportation improvement projects planned along the Corridor.

During the next three years, the 50 Corridor is scheduled for more than thirty transportation improvement projects. It is our belief that coordinated efforts for remediating the Western Groundwater Operable Unit must take into account the impact of these vital transportation projects. These improvements include High Occupancy Vehicle (HOV) lanes for Highway 50, road improvements for Folsom Boulevard, a major overhaul of the Sunrise Boulevard interchange and the extension of light rail to Folsom (including a grade separation at Sunrise Boulevard).

During this time, a community outreach campaign will be conducted on behalf of Caltrans, Sacramento County and El Dorado County to inform commuters of alternative transportation options and detours over surface streets to avoid traffic congestion. Alternative 4C's requirement for installing a series of redundant wells and an additional 2.5 miles of water lines through the Rancho Cordova community will seriously impede the redirection of commuter traffic during this heavy construction period.

Both alternatives stop the contaminant plume and provide safe, clean water. Both alternatives have the approval of the State of California. Thus, we believe that due to the transportation and mobility impact to this major commute corridor and the communities it serves, Alternative 4C is not the appropriate remediation choice.

The FRED TMA supports Alternative 4B.

<u>USEPA Response to Comment #470:</u> Alternative 4B is not as effective in preventing spread of the groundwater contaminant plumes because it allows contamination to migrate into large areas of the aquifer that are currently clean. Because contaminants are allowed to migrate, necessitating cleaning up a much greater contaminated area, it will take an additional 108 years to cleanup groundwater if Alternative 4B was implemented. This would result in additional disruption to the community because it will likely be necessary to dig up the pipelines several additional times for repair and/or replacement during the 108 year period. See Response to Comment #469 pertaining to traffic disruption.

The additional wells in Alternative 4C are not redundant, but are necessary to contain the groundwater contaminant plumes in the D and E aquifer at their current extent.

471. **Letter from the Sacramento Metropolitan Chamber of Commerce, Russell J. Hammer** (1/29/01): On behalf of the Sacramento Metropolitan Chamber of Commerce, I am writing to commend Aerojet and the EPA for having developed an effective and reassuring remediation program for the Aerojet Superfund site in Sacramento County. We at the Metro Chamber are very encouraged at the progress that has been made toward developing a comprehensive cleanup on this site.

The Metro Chamber also would like to express its support for remedy Alternative 4B. As we understand the situation, both Alternatives 4B and 4C have been determined to provide the highest level of protection of surrounding neighborhoods, will stop the spread

of the contaminant plume and will provide safe and clean water to those homeowners and businesses who have been impacted by the groundwater contamination. The primary difference between these options is the number and placement of extraction and treatment wells on the western side of the Aerojet property.

As representatives for the region's business community, we believe Alternative 4B is the preferred alternative for the following reasons:

It requires fewer wells and pipelines, thus less intrusion and disruption to nearby residents and businesses during drilling operations.

Much of the required pipe in both options will be placed along roadways in the region, thus disrupting traffic during construction. Because it involves fewer miles of pipes, Alternative 4B is the preferred option from the business community's perspective.

While Alternative 4B has lower capital costs associated with it, it could require a longer period of time to treat all of the impacted groundwater to safe levels. Thus it could well prove to be the more costly of the alternatives. However, Aerojet and others fully expect improvements in groundwater remediation technology to significantly shorten the lifespan of this effort. We believe Aerojet should be able to implement the most cost effective treatment plan in order to fully realize the efficiencies and savings that result from the improved technologies that are certain to be developed in the coming years.

Again, I want to emphasize that our preference for Alternative 4B is predicated on our understanding that both of these options will fully remediate the groundwater contamination at the Aerojet site, will stop the contamination plume from further migration and will provide safe and clean alternative water supplies.

The Metro Chamber believes that Aerojet's parent company, GenCorp, is a leader in our regional economy and has demonstrated its commitment to addressing forthrightly and completely the very difficult challenges it faces. We applaud the company and the EPA for developing a long-term solution to this problem.

<u>USEPA Response to Comment #471:</u> See the responses to comments #469 and #470.